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British Medical Association.

SPECIAL CLINICAL AND SCIENTIFIC MEETING.

THE NEW BIRTH OF MEDICINE.

AN ADDRESS TO THE MEMBERS OF THE SPECIAL CLINICAL AND SCIENTIFIC MEETING OF THE BRITISH MEDICAL ASSOCIATION, LONDON, APRIL, 1919.

BY SIR CLIFFORD ALLBUTT, K.C.B., M.D., F.R.S.,

REGIUS PROFESSOR OF PHYSIC IN THE UNIVERSITY OF CAMBRIDGE; PRESIDENT OF THE BRITISH MEDICAL ASSOCIATION.

THOUGH the plans of this special Clinical Meeting of the British Medical Association—held for the purpose of bringing to the minds of all of us by way of discussion and demonstration the lessons learnt in the war—do not include the delivery of addresses I think it becoming that I, who have the fortune to be the President of the Association and of the meeting, should present to those attending it some words of welcome and some thoughts that have long been dwelling in my mind.

That we meet together to-day at the greatest moment in the History of Medicine seems an audacious claim; how shall it be justified? Not merely because this is a gathering of the physicians of nations, commonwealths, dominions, colonies, and friendly nations, to consider the lessons of a great war, great as such an occasion is; not only because the medicine of modern peoples and empires has vindicated its ascendancy in the greatest war of all time, but chiefly because at this moment it is revealed to us that Medicine has come to a new birth, and in this regeneration has fought on no unequal terms with other arms in a glorious campaign. It might have been supposed that in war there would be no time to think, only to do; but we are surprised to receive enormous gifts to medical science from the great caravan of our returning pilgrims.

In former wars deaths by disease were many times more numerous than by battle; perhaps four or five times more. In South Africa the enteric fevers were more destructive than battle; in this European war this disease, owing to scientific prophylaxis, became almost a negligible factor. Indeed in the West the average health in camp was even higher than at home; and in bad quarters such as Salonica or Mesopotamia, principles of pathological biology were put in action—as they were in Panama—which brought infections down as low as time and occasion could permit.

THE NEW BIRTH OF MEDICINE.

What is then the new birth, this revolution in medicine? It is nothing less than its enlargement from an art of observation and empiricism to an applied science founded upon research; from a craft of tradition and sagacity to an applied science of analysis and law; from a descriptive code of surface phenomena to the discovery of deeper affinities; from a set of rules and axioms of quality to measurements of quantity. When I turn back to the medical textbooks of my pupilage, to the wise and scholarly Watson, or the respectable Alison, and contrast them with the textbooks of to-day, I marvel that a change so vast, so profound, so revolutionary, should have come about in one lifetime! Many a generation had to pass before Harvey's researches established animal mechanics; many again before the half-lights on animal heat of Willis, Mayow and Boyle were brought to quantitative verifications. In Medicine observation cannot carry very far, not so far, let us say, as in astronomy; while skill and sagacity, if they do not die with the individual, keep in the axioms and exercises of the school but a transitory life. No observation of a thunderstorm could unravel its affinities to the action of a loadstone on a scrap of iron; no observation on diet could reveal the relation of food protein, by way of the amino-acids, to the tissues; no observation bestowed on scurvy or beri-beri could detect the occult and elusive but all-potent influence of the vitamines; no observation of secretory and muscular action could reveal the play of surface tension in muscular contraction, nor its relation to lactic acid and oxygen. By what sagacity could the shrewdest observer, let us say of heart disease, perceive the likeness of the formations of a soap bubble, or a raindrop, to the contraction of a muscle fibre in terms of its length; and that muscular contraction is not so much a chemical as a physical system with a negative temperature coefficient. Again the relation of sexual hormones to the development of men and women, and to the phases of their respective organs of reproduction, is an issue of the academic laboratory. The prodigious harvest Medicine has reaped in the present campaign from the original researches of a chemist into the occult causes and laws of fermentation by microbes, and from a field apparently so alien as of the silkworm disease, we now celebrate.

SCIENCE AND PRACTICE.

One of the main lessons of our history has been that, in neglect of research into truths below the surface, Medicine, for lack of a deeper anchorage, has always sunk back into empiricism and routine. Thus the great period of Ionian scientific insight, with its Hippocratean medicine and surgery, waned until the new birth of science and medicine

in Alexandria, as reflected for us in the pages of Celsus. Then, as research languished, the drift was downwards again to rule of thumb and recipe therapeutics; though once more by the physiological researches of Galen it was transiently lifted up until the obscuration of all science in the long Byzantine and medieval eclipse.

Yet, even during this period of secondhand knowledge down to Paré and Wiseman, medicine was at intervals stirred in its sleep by adventures of surgery which, then as now, carried a certain turbulent and provoking inquisitiveness into the complacent pomp of its medical tradition. And let us not forget how many of the greatest men in medical history, from the wars of cloud-topped Ilion, to those of Greece and Rome, and of modern times, had been on military service.

That every cell in the body is a microbe producing its own secretion, which we may call secretion, hormone, or toxin according to our regard of its values—some indeed such as trypsin being beneficent in certain relations, maleficent in others—is now apparent; and these several specific energies are gradually being reduced to experimental measurement; quantities upon which is being built that large and growing system of reinforcement and inhibition which, in its applications in this war, has saved more lives than the sword has slain. The skill, sagacity, and aphorisms of Hippocrates, the skill, sagacity, and aphorisms of Sydenham, did useful work for mankind in the twilight. In the great hospitals of England skill and sagacity, qualities in which the English physician is unrivalled, are eminent at the bedside and in the classroom. In no country has the pupil been so well taught to make use of traditional and empirical knowledge, to apply this handy knowledge, quickened eye, and clever resource to immediate necessities. But to-day physiological and pathological science is running too fast for this medicine of individual and empirical authority, medicine which formerly I have described as up to date but not beyond it; the medicine of the day but not of the morrow; the studentship of the diploma but not of the university. Now we have to stint even this moderate commendation; the advances and accomplishments of the ancillary sciences are becoming too swift, and too exacting both of time and training, for the clinical worker to keep pace with them, or from them to select fertile principles for application to his immediate work.

No man, be his faculties what they may, can be at once physicist, biochemist, pathologist, practitioner and sanitarian; yet he has to treat—let us say—dropsies on principles of osmosis, diabetes on those of biochemistry, anaemias on those of physiology, malarious, yellow and trench fevers on those of minute parasitology; and so on.

The working physician cannot be a biochemist, nor a biologist, in the academic sense of these studies; any more than an engineer can in this sense be a mathematician or a physicist. Without academic study the engineer had by rule of thumb built bridges, towers and aqueducts, if simply and rudely; but, as far more than this is now required of him, so far more is required of the physician. Without physics and biochemistry we cannot find nurture and growth; from the breasts of these nursing mothers we likewise draw our life. Disinterested academic students of biology and biochemistry, if not indifferent to practical needs yet unchallenged by them, have been and still are, working on larger and remoter issues; pregnant indeed with the future but in some isolation from the feats of the clever craftsman—surgeon or physician—dealing in a tentative and empirical way with conditions that will not wait. The scientist is in a balloon and his outlook spacious; the eye of the craftsman is quicker for contingencies but his survey narrower; the craftsman sees the trees, the academician the wood; neither has put into common stock all he should give to the other. But the academician, recognizing the fertility of practice in new and diverse problems, is keener to co-operate with the craftsman than he with the other.

Need for Mediating Machinery.

Between these departments of research and practice there is needed a mediating system; a technical school continually to co-ordinate the growing principles of the laboratory with the accumulating contingencies of practice. As I have said, the busy practitioner cannot be a master or even a disciple of these several departments of science, yet he must be so instructed in the broader principles of them that he shall be not only in a position to recognize their applications to practice but, if he is to be a teacher, to perceive moreover the emergencies of these principles in their several fields, so that he may apply them to his own industry and foresee wider and wider occasions for such applications.

To genius we can set no bounds, but I have asked myself sometimes if Lister would have worked out his great research if, instead of being in Edinburgh, he had been in London. Why should he not? Well because in Medicine London is but a factory; Edinburgh is also a technical school with its technical professoriate animated by an academic spirit. But when my pupils leave Cambridge for London, imbued I hope with some scientific ideas, and somewhat enlarged in scientific imagination, they begin there to lose much of this outlook, much of these ideas. Fascinated, as justly they are, by the practical wisdom, sagacity, ripe experience and clever resources of their medical and surgical teachers—for as practitioners, I repeat, these are the best in the world—the pupil loses vision of Medicine as a science. He returns to us for examination an excellent apprentice, but no longer of the company of the prophets. For a diploma, for the doctoring of the day, he is good; from an academic standpoint, from an outlook to the medicine of to-morrow, from a vision of the continual carrying and weaving of the yarn of biochemistry and biology into the web of his art, he has fallen away. For him the future lies undisturbed and unquestioned; the spirit of curious investigation has evaporated. As I have said on former occasions, Harley Street is the grave—shall I not say the cemetery?—of clinical research. How many a brilliant colleague who as a Professor of Medicine, Surgery, or Gynaecology would have shed light upon his profession and his school, yearning it may be for a sphere of research yet finding no other career or means of livelihood open to him, has been driven to throw up all this mediation between his art and its sciences, all effort to tear her secrets from nature, all hunger for things to come, to bury these talents in practice.

These reflections may seem unfit for a world audience, more appropriate for a domestic homily; but, from the home which I know best, I tell a tale which is of universal application. I return to the great occasion on which we are met. By this war, whether doctors or combatants, we have been thrust into new problems; we have been shaken out of mere readiness of resource, mere experience, mere sagacity, and compelled to that new curiosity, that passion to wrest new secrets from nature, which fortunately had made some way before the war; and was then turning Medicine from an observational and empirical craft into a scientific calling. The Committee for National Research, established in 1913, was one mark of this change, and in our crisis has shown itself as the spirit and the organ of advances which I have been tempted to call stupendous.

Sometimes it is said that to carry instruments of precision to the bedside blinds the student; that in fadding with instruments, even with the stethoscope, he forgets the use of his eyes. Is it true that instruments of precision, while opening the eyes of the observer to deeper and less obvious processes, closes them to the plainer features of disease? Surely the chief differential features of—let us say—tabes dorsalis were as manifest to plain observation before the advance of scientific research as they are to-day; indeed the chief work of my old master Duchenne was of a descriptive kind, well within the range of unassisted vision. Why was it left to Parry and Graves, not a hundred years ago, to describe Exophthalmic Goitre; or Myxoedema to Gull and Ord? The tests known respectively by the names of Babinski and Kernig, were within the reach of the physician before the pyramidal tracts were dissected, or the pathology of posterior basic meningitis laid bare. Why was it left to our own day to distinguish typhoid from typhus fever; or Hodgkin's disease from scrofula? The truth is, the spirit of research, far from dimming the eye, quickens it. In science there is no place for skipping. Look but aside and nature gives you a cuff on the cheek. If the hasty student prefers his stethoscope to his eyes he is soon pulled up by nature herself, if not by discipline.

Research is the salt of the most practical training; it

cannot begin too soon; it is the light of the wisdom of the man, of the mind of the boy, of the heart of the child. Education has lingered on Hellenistic and Scholastic ways, on the systems of abstract notions unvexed by verification, so long that the hard-shell practical man is still occupied by the notions of antiquated theory and the phrases of a dead or moribund nosology. The majority of medical men have to work upon the store of scientific ideas and facts with which they set out in practice; onwards they may gain in adaptiveness and technical facility, but can dig little deeper into the strata of knowledge; but for the modern academic spirit this would spell, as in our history it has spelled, stagnation. Therefore it is of the greater importance that every student should start on his career well equipped with scientific principles. If thus equipped he be not at first so handy a doctor as his seniors, with his larger mental grip he will soon pick up common devices and apply them with more freedom and economy.

On the other hand, it is right that the working doctor should refuse to be jumped too readily by the new lights. He has long been scenting his way in the bush and tangle, and has gained a certain pathfinding instinct; he is responsible for the safety of his patient, and has to see that he comes to no harm by overdriving of principles untempered by a sense of contingencies, a sense with which the English doctor is richly endowed. Notwithstanding, no man can deal well with a very complicated subject, such as medicine, without an enormous underlying framework of precise knowledge; and it is as knowledge becomes quantitative that solid progress is made. Happily this greater precision, far as it is from fulfilment, is manifest enough in the work of our own generation to give us encouragement.

Physics and Medicine.

Let us glance, however hastily, towards some of the paths on which we go to meet new knowledge. In the venerable study of anatomy in its static aspects the student has long been taught the value of precision; but the recent tide of anatomical study towards its dynamic aspects, as by the work of Sherrington and Head, is bringing in new currents not of theory only but also of practice. Of other casements opening upon new visions of medicine that from the chambers of Physics is perhaps the most arresting; at any rate at present. How fascinating, in their application to pathology, are the principles of osmosis with its curious reversals, of surface action and adsorption, of electrolytic differentials and electric methods of taking quantitative measurements, of mechanical pressures in the circulation of body fluids and, in the heart, as measured and graphically delineated by Hales, Ludwig, Gaskell, and Mackenzie, of the behaviour of fluid veins, and of the relative diameters, normal or variable, of the cardiac chambers and their main outlets. I need not do more than allude to the recent work on the CO_2 tension in the pulmonary alveoli, and to its immediately practical bearing on so-called acidosis, on the treatment of persons gassed in military or civil operations; and so forth. By physics again we are shown, especially in plants, how in life the less complex molecules are working not only in planes below those in which the higher functions are developed, but upwards by pacific penetration moderate where they do not command. How instantly such researches as these must govern the practice of medicine we perceive, for example, in the gum-saline treatment of surgical shock. It would seem indeed that some of the most mysterious phases of immunity and anaphylaxis, of phagocytosis, as also of narcotism, may depend, at any rate in great part, on surface action; and that the behaviour of lipoids released from disintegrating proteins may lower surface energy, as in the retention of water in renal dropsy; or again in a different field may determine the touch or the permeability of synaptic neurons. These, and such physical laws, as they are revealed to us, teach that the multiplication and co-ordination of surfaces, let alone their chemistry, are operations which do not arise in mere mixtures of the same ingredients. So far it seems as if all biological reactions are determined by physico-chemical laws—that is, by molecular structure. The laws of selective absorption, as revealed in incandescent vapours, might throw some light upon those of biology; for in both fields we have to study vibration of molecular systems in unison, harmony or discord.

It is the business of an artist to create, but of the scientist to analyse and separate the elements of form, and to verify them by partial syntheses; and these physical and chemical categories—improperly called mechanical seeing that they are self-active and self-constructive—we have to exhaust before we search the skies for a "vital force." One chief direction of our work must be to find methods of serially reducing these planes of functions one by one, so as to suspend inhibitions stage after stage, and by taking it to pieces to reveal the construction of the organism.

Biology and Medicine.

When we rise from physics into systems of biological activity two conceptions especially strike us as new and marvellous; namely, those of the colloids and of the cell. But throughout these systems we shall find the physical phases, if no longer constructively dominant, yet still active and effectual. We cannot even guess at the links of these chains where physics recedes and biochemistry takes the lead. The mere size of the molecules now concerned alters their relation to the spaces in or about which they move; not only so, but in organic compounds a mere change of position of a radical profoundly alters the properties of the compound and leads to manifold changes of function.

Often moreover these changes, as in the cases of Immunity and Susceptibility, do not vary gradually but by leaps and bounds, as musical flames respond to scales of vibration. Thus great diversities, contrasts, and strange conjunctions of morbid phenomena do not necessarily signify great divergence of nature in the morbific agents; so that again we cannot get very far by grouping phenomena by direct observation. Processes outwardly disparate may be alike at the core. A small and latent change of chemical constitution may turn a benignant into a virulent substance, and conversely; as we may see in such substances as cacodylic acid and the cyanides, or as saliva, serpent's poison, and trypsin; and so forth. On a small deviation in a secretion we may be destroyed by those of our own household.

How far are hormones a particular category, how far universals? Do they differ in nature from other secretions, enzymes, antisubstances, and so on? Do they by their interactions, compensations, and inhibitions cover the ground of concerted chemical action in kind, as the nervous system does in time; or are they few and peculiar to certain limited needs? Whether inhibitory or stimulatory may often depend rather upon the term of the series to which the hormone is applied than to a difference in quality. Merely to glance at such questions as these reveals to us how vast is the realm of knowledge yet unconquered, nay undiscovered.

> . . . mazes intricate,
> Eccentric, intervolved, yet regular
> Then most when most irregular they seem.

A very interesting transition from physics to chemical biology is found in the phenomena of catalysis. By some elusive property certain inorganic substances—spongy platinum for example, or manganese dioxide—themselves unaltered, exercise an accelerating influence upon chemical change; properties which are utilized to-day on an enormous scale in industrial processes. Now by our increasing knowledge of biochemistry we perceive that the function of which the inorganic catalyst is a simple case, is manifested also in more complex orders by certain enzymes, or colloidal catalysts, upon which depends in great part the sweep of our health and of our diseases. In these enzymes which accelerate metabolism we may admire again, as in the simpler catalysts, the exquisite economy of energy in vital processes; how small the energy transactions may be, and these often reversible, which may compass great ends. A striking example of such economy is now being demonstrated to us in the calculated balances of voluntary muscular activity.

To illustrate the bearing of biochemical research upon practical work let us consider the value of what I may call for short "Ambard's constant," of which few practitioners seem to be aware; namely the standard of

non-protein nitrogen in the blood. Yet here is an instance of laboratory work of immediate practical importance. Recently I had in hospital two elderly men suffering from prostatic retention and vesico-renal strain of degrees clinically inappreciable. Mr. Sidney Cole estimated for me the degrees of this non-protein nitrogen, and, taking the normal as about 50, in one of them the amount was 224, in the other 227. One of them had already undergone excision of the prostate, and as regards the operation successfully; but soon afterwards the man became uraemic and died. In the other case operation was of course declined; the man was sent home instructed in the use of the catheter, and for treatment for his renal condition.

The balance of hydrogen and hydroxyl ions in the blood, which, as in diabetes, may be a coefficient of many obscure and perilous symptom groups, and other conditions of ionization, such as modifications of secretion and enzymic action, of the heart-beat, of the constitution of the blood and so forth, belong to a subject now so well known as to need but an allusion; yet all this subject again is one not of direct observation but of profound physico-chemical research.

The economy of energy is nowhere more manifest than in the universal system of inhibitions; from the moment that a second field of energy is added to the first interferences occur, and inhibitions are established. Thus—to take a familiar example—thermotaxis is steadiest in man, though in him still tidal; is less steady in the child, as we see in the remittent type of its fevers, and so downwards to animals with no thermotaxy.

Thus we shall work on Aristotle's double track, the track of the one into the many and of the many into the one; and on the Heraclitean paths ἐς ἄνω and ἐς κάτω. Permanent inhibitions are no doubt static and established in structure, but this need not be true, and probably is not true, of all inhibitions. Transitory inhibitions are probably occurring continually, both in health and under infections, and may be due to condensations on surfaces, temporary solutions, ionic conversions, hormones, and so on.

Diet and Nutrition.

Diet we shall say is surely a matter of observation and experience; on diet physicians have written, and written well, from and before the time of Hippocrates. Furthermore, during the last half-century the subject of dietetics has been strictly analysed on quantitative lines, and its energies calculated in caloric and other units. Yet even herein our attainment is far from complete. About this well worn, almost hackneyed subject a breeze of new and far-reaching ideas is gathering. Our balances, as in the children's milk, and in the analysis of the diseases of deficiency, are eluded by imponderables, by the infinitely little; our quantities are set at naught. For health and disease the new vitamines, like some other hormonic and enzymic imponderables, are as potent as they are intangible. Hormones work in infinitesimal ranks; and I believe no antibody has as yet been isolated. Once more we find that nature laughs at our formal categories, at our several compartments of protein as such, of carbohydrates as such; a straitlaced reckoning. No one class of foods, it appears, will build or burn without another; carbohydrate metabolism leans on the protein, the protein on carbohydrates, and all these on the fats, in mutual function; each of these is engaged in the totality of the chemical changes. For instance, deficient carbohydrate means deficient oxygenation of fats, and imperfect protein distribution.

Nor is this all; some of our great ancestors, likewise having penetrating ideas of the infinitely little, supposed that the sources of nutrition must contain a supply to every living tissue of the same form of minute identical elements; be it of bone, of muscle, of blood, of "nerve," and so forth; each being proper to its peculiar tissue to which it attaches itself (Homoeomerism). This crude notion, it is true, made no great way; still until lately we have all of us supposed some, if a more general, congruity of form between the nutritive elements and the qualities of their various destinations. But the study of the reduction of foods to amino-acids, and issues of like researches, are telling us to-day that there is no necessity even for the food proteins to be of similar constitution to the tissues which they subserve. To the almost magical part played by certain elements, such as calcium, as stabilizers, or of the alkali-metals as labilizers of equilibrium I need but allude. The bearing of these dietetic researches upon practice, for example in the treatment of diabetes, are too obvious for reiteration.

If we turn now to the cell, as described to us by Virchow, we realize that our knowledge of this tiny microcosm is as yet only beginning. The infinity of extension is not strange to us, for some of it we can see; but the infinity of the universe of the little, which far escapes even our microscopes, does not strike the imagination. Still even of this inward universe and its intense activities, as by present research they emerge into the field of the mathematical physicist, of the spectroscopist, of the radiologist, of the physical chemist, we are beginning to conceive something. Man is no longer the microcosm, but the cell of which he is built. To our wonder we see that, even within such tiny spheres, some of them filtrable, are multiple systems moving in relative independence of each other. The cell membrane is formed chiefly perhaps by the physical processes we have considered. Yet puzzling and intricate as these reactions are, they are all-important to the physician; as for instance in the relations of the glomerular epithelium to sugars; its unerring discrimination between substances, even isomeric, in the blood, as between glucose and lactose; or again in the constant and subtle opposition of the normal intestinal epithelium to the entrance of poisonous elements, or foreign proteins, into the vessels and tissues.

Specificity in Biology.

When Professor Nuttall demonstrated to me his first precipitin reactions I wondered at the prevalence, in the labile fields of biology, of a specificity like the static identities of the inorganic; a specificity moreover not in cell structures only but also in their products, and in the animal juices. How far this individuality extends to the cells and saps of plants I do not know; but in animals we see at once how the native juices resent the invasion of an alien, not only of enzymes and colloidal bacterial toxins, but of normal foreign serums. Even among lice and fleas each species has its specific host. But it seems inconceivable that the body should keep in store an armoury of antisubstances to meet every possible antigen; is there not some more general potential from which the specific response is more or less determined by the peculiarity of the invading material? Thus the use of tobacco, for us only three centuries old, after a while calls forth in the liver an antisubstance to resist it; a slowly gained immunity, it is true, but perhaps not unlike in kind. There is some evidence that antisubstances may adapt themselves to the chemical form of the antigen which calls them forth. It is said that, at any rate in anaphylaxis, there is a margin of mutability or lability—as distinguished from neutralization or digestion; something, as observed with approximate antigens, short of absolute specific stability. Some suppose a certain adaptability or elasticity, which, while bending to variable stresses, may be consistent with a fixity of specific structure. The almost startling success of a vaccine or serum now and then amid a series of disappointments, indicates however that some close specific correspondence is necessary for success, and must be exacted in our methods. At any rate the closer the correspondence the less the time and dose required. We must "run it fine." In the cells themselves, even in the lowest bacteria, molecular elasticities seem so far defined in direction that specificity is surprisingly stable; although, in such rudimentary forms of life, lability, and even mutation, might have been expected. Indeed in serology and agglutination we seem to be compelled to steer an exact course between strains of bacteria so akin as the several typhoids, meningococci, coliforms, diphtheroids, and even tetanoids. Yet probably some of these variations are not so individual but that they can have preferential affinities and antagonisms outside their main characters, and show a relative sensibility to various antigens. On the other side of the subject a curious comparison may be made with those species, more obviously of plants, in which, as in the poppy, the foxglove and the calabar bean, antagonistic substances abide together undisturbed.

Moreover there are contingent conditions to be reckoned

with, auxiliary or hostile; such as concentrations, ionic reactions, surface actions, and subsidiary co-operative substances. Indeed the effect of a vaccine in saving a patient from a virulent infection is hard to understand; it is hard to see how a man can be saved by instilling yet more of his disease. It may be that the vaccine calls forth a response from the deeps, antisubstances or co-operative agents, from some remoter regions of the system, which the primary infection had not awakened.* We are told that in typhoid fever the vaccine, especially if repeated, calls forth stronger antisubstances than does the primary infection.

Among the gravest of medical problems is this of chronic infections. How far are the conditions which shorten the full span of life implicit? How far due to the effects of poisons working insidiously over many years? Do we die by natural gravitation, or "driven from our orderly spheres"? In this abstruse inquiry laboratory research must go hand in hand with clinical observation. No less urgent is the wide and manifold question of carriers: what in them are the conditions of bacterial survival, and what the means of extirpation of their parasites?

Immunity and Anaphylaxis.

From specificity we may go forward to the subject of Immunity and Anaphylaxis, one on which I hardly dare speak before this audience. In this sphere of science and practice throughout the war you have fought with the foremost. I am but a child in this matter. Like a child I was fascinated by the side-chain hypothesis of Ehrlich, which, whatever its ultimate truth, has been at least a scheme welcome to give some order to swarming facts and ideas. The term antigen may be enlarged to signify any protein, or unknown substance closely bound to protein, which is foreign to the species into which it is introduced. It is said that in the course of a disease anaphylaxis may so intervene as to appear as part of the original malady; that, for instance, certain features in syphilis called parasyphilitic are but anaphylactic. But even here, again, we may have to deal in considerable part with physical laws; the fixation of complement may be due to adsorption, and a colloidal precipitation at the surfaces of sensitive cells may modify their permeability. Bacterial toxins may all be colloidal; and protein may be inseparable from such antigens as animal extracts. The sudden, often instantaneous, onset of Influenza, and likewise, after a long period of dejected convalescence a release as sudden, suggest that the toxin may not necessarily enter the cell and work its evil therein, but may adhere for a while to the tissue elements, and after a variable interval detach itself. So again the well known but very remarkable cases of insanity in which intervals of health prove the nervous structures to be unimpaired, suggest adsorption, or temporary alterations of a physical kind in cell permeability. Nevertheless the hereditary element in these cases indicates that in such patients there is a co-operating proclivity, which, however, as probably in the case of pulmonary tuberculosis, may depend upon a local warp of structure. To attribute it to a "soil" is mock knowledge, and perverse at that; soils do not attack but cherish the implanted germ. The no less remarkable alterations of sensitization and desensitization may in like manner depend on molecular physics.

With the large, various and recondite problems of psychology, accentuated and multiplied by the war, it would be impossible within these limits to deal even summarily. But two aspects of the subject I cannot leave unnoticed; the problem of fatigue, and the calculation of individual faculties for particular kinds of work; the proper distribution of the round and the square men. For the field of psychology adaptations are to be ascertained in a manner analogous to that of the selection of airmen. Here again laboratory research is laying the foundations for precise knowledge in a sphere which voices of the mist had proclaimed as their own; where they had ruled opinion, and even declared themselves irreducible to law. Reason, it is true, is our last and least organized faculty.

Statistics.

The study of Statistics, not long ago the prey of the scoffer, is, under academic methods, such as those of Brownlee and Greenwood, emerging as one of our most potent instruments of practical medicine, both on its prophylactic and on its interpretative side.

Comparative Pathology.

I have dwelt upon the isolation of the academic from the clinical worker; but I have to denounce an insularity even more blinding than this; the almost complete lack of any systematic provision for Comparative Pathology. As I urged upon this Association in my Address in Medicine at Glasgow in 1881, and persistently since, in Medicine we are still in the Ptolemaic stage of ideas; we are still anthropocentric. And Veterinary Medicine in its several compartments is still more narrowly confined. Even among mankind, research on the Ethnology and Geography of disease has been but fragmentary; incidental studies with no comprehensive view; and yet with the disturbance and redistribution of peoples the study of racial and regionary pathology is becoming less and less possible.

Do the children of the darker people in towns outlive the fair? and if so why? Are the darker people gaining in numbers upon the fair? We have to learn how diseases vary with the systems of external relations, the conditions of time and place, of season and soil, race and temperament; and this not in higher organisms only, but also in the lower and lowest. Hysteria is, or was, rare among our Yorkshire folk.

Again, the facts of heredity in disease, hard to gather in long living Man, are comparatively easy to collect in animals and plants. What is the extra vigour of cross-breeds? Has each strain of pedigree stock its own morbid proclivities, so that we might compare the several series of each kind?

Yet as the individual is but a link in the chain, so the human chain is a strand in the web of all living things. We must know all disease to understand its several phases. *Nemo alicujus rei naturam in re ipsa feliciter perscrutatur.* "Every class of animals," says Sir John Bland-Sutton, "is distinguished by anatomical details, habits of life and milieu from other groups, differences which involve liabilities to certain diseases, immunity from others. So far as our present knowledge extends we know that certain diseases occur with extreme frequency in one class of animals and are rarely seen in another." We want then natural groups and groups in natural series, and this means all life. How far have we got in the classification of all disease which, on a natural system, is a measure of our knowledge of it? Changes which are morbid in man may be normal in lower creatures; such for example as the large sequestrum of the antler of the stag. Why is cancer almost unknown in wild animals, caged or free? It is said to be unknown among the Esquimos. This cannot be due merely to average age. If atheroma of the great vessels, or of those of the limbs, is not found in old horses or cattle, why is it not? Is it due to special products of catabolism? Phlebitis is, I believe, rare in animals. What is the relation of the mucin retrogression of myxoedema to the like connective tissue of the fetus, and again to the tissues of certain lower animals? Is a gouty man a kind of bird? How large is the field for the study of racial immunities—of the resistance of certain silkworms to the silkworm disease; of Cochin China fowls to chicken-cholera; of the field mouse to the septicaemia so common in the house mouse (Pasteur); of the Algerian sheep to anthrax, of goats to tubercle, of dogs to glanders (as contrasted for example with the guinea-pig), of Darwin's Florida black pigs to bloodroot, and of the susceptibility of the white pigs to buckwheat? How curious is the tolerance of rabbits to morphine! What do we know of rheumatic fever and carditis in animals? In what respects does a theromorphic heart differ from that of an intrauterine endocarditis? In the fundamental phenomena of life in animal or plant there is a fundamental unity, and as in different organisms these are variously ordered cross-lights are thrown upon their origins and serial distributions. Some animals or races seem more disposed to mesoblastic diseases; others to nervous disorders; and so on. By observing organisms thus in

* I leave these words as written two or three weeks ago, and long in my mind. Sir Almroth Wright has since expressed a similar opinion with an authority and proof to which I cannot pretend.

many series we may unravel the constituent parts of the more complex in a way which we cannot do by dissecting these from level to level. As some one wittily remarked, "a minster in decay does not break up into parish churches." But a study of parish churches has thrown a flood of light upon the growth of minsters. Comparative Pathology is needed therefore to indicate steps of development, so that we may not contemplate diseases merely as injury or dilapidation but also as phases of biology. Each advancing stage is longer in building than that below it. Some phases are better studied in lower creatures, even in plants; some better in the more complex.

For the Future?

I have glanced thus rapidly over the field of the medical sciences to reinforce the lesson of their profound and instant bearing upon practice, and the need of linking up the laboratory with the wards. This lesson, this need, I have urged for many years; for instance at the Annual Meeting of the Medical Society of London in 1907 I urged upon the great schools in England the vital importance of establishing professors of Medicine, Surgery and Gynaecology, as middlemen between the isolated academical worker and the practitioner, between the field of immediate interests and the field of ideas. If I am not a practical man I am nothing, but still I am convinced that only by disinterested research on the large patient and prophetic lines of the pure sciences can progress be made. The isolated academic worker, as well as the practitioner, loses by this isolation; he loses the spontaneous outcrops of problems and crucial instances which so often spring up in practice, but fail to show themselves in the laboratory. So complete and mischievous however has been the barrier between research and the industry of Medicine that a reaction from "laboratorism" to symptomatology has set in, because there are no intermediary workers—no engineers—between the knowledge getters and the knowledge dealers. Thus we see the laboratory investigators completely out of touch with practice, and practitioners faithless of theoretical principles—just "Philistines." A few years ago my own University, or certain members of it, discouraged the establishment of a brewing school for which endowments were offered; utterly ignorant and careless as they were that Pasteur's great discoveries began in the wine vat.

There are then three ways in which Principles may be used. They may be taken for granted in a routine dexterity without being understood, as are those of electricity by telephone and electromotor operators and laboratory attendants, in the manner of a blind man tapping with his stick; or they may be fully understood and developed, as by the academician; the third way is that of the technical professor who receives and digests so much of the abstract science as concerns his own industry. Thus as the engineer is something of a mathematician, something of a physicist, so the professor of Medicine must be something of a physicist, something of a biochemist. Through these middlemen the scientist and the practitioner should mutually feed each other. The absence of biochemist and pathologist from the bedside where lies the stuff of their researches, is lamentable. In every adequate clinical school then there must be a *professoriate;* whole time—or nearly whole time—professors, with technical laboratory, biochemical and pathological, who with their assistant staff shall be engaged continually in irrigating our profession from the springs of the pure sciences. From them should radiate what is called an "atmosphere" through the wards; for it is true that the professor himself will be less occupied in teaching the ruck of students; he will gather about him some senior students and all the younger graduates who still frequent the wards. Moreover I quite agree that for variety of reflection and resources there will still be no less a place than as at present for the classes of the Honorary Staff.

Post-Graduate Systems.

Now, in conclusion, this is the true and only factory through which the post-graduate systems, so much needed and discussed, can thrive and develop. For such reasons I could not see my way to co-operate in the scheme, now being proposed, of post-graduate courses to attract men of other countries, and of our own. This scheme was tried devotedly and most ably by our late dear and brilliant colleague Jonathan Hutchinson. But being founded on no professoriate it had no roots; when Hutchinson was gone the scheme dried up: and it will dry up again unless it be an outgrowth of a scientific system, and flourish on the stem of a professoriate and be rooted in the ward and the laboratory. A post-graduate scheme consisting of desultory side-shows will not continue to draw serious visitors. The visitor wants not cut flowers but a nursery garden. If students are to come to study Medicine in England—for these strictures apply particularly to England—there must be something large and creative for them to come to. Given a professoriate, the special departments of our great hospitals offer a rich soil for the scientific garden, and a larger and more liberal outlook than the islands of the several specialist hospitals. We know in Cambridge how advance is forwarded where laboratories are close neighbours. Science is as intolerant of limits as of dogmas.

It is true that much has been done of late to stimulate and enlighten both medical men, the public and the services concerning the need of systematic pathological investigation, but the mulish aversion from such pursuits often passing into active animosity, is by no means yet extinguished in the national services. Actual discouragement of research work, in some quarters perhaps at home, in many I fear abroad, is still by no means unknown. Young men, as ardent for knowledge as for their regular duties, find that pathological inquiry, and even laboratory appointments, lead to no promotion, may entail positive sacrifices of pay and other advantages, and sometimes indeed vindictive reprisals. As the more antiquated traditions of the services are dispelled things will mend; the sympathetic response of the India Office but the other day to a deputation on this matter promises well for the future; notwithstanding there are yet many dark places in the Empire which need the lantern and the besom. Not only must laboratories be established in all Colonies and Stations—and, let me add, in every English county, a scheme which was provided for by Mr. Lloyd George in the Budget suppressed by the war—but these and their workers must be restored to the full stream of official recognition and reward. It is sad to think of the many men of talent, even of genius, who have been thwarted so long in their devotion to research that the benefits which they could have bestowed upon mankind have been maimed, or frittered away.

But now the politician, throwing up his hands, exclaims: What is to be the cost of all these medical developments; academic, laboratorial, professorial, prophylactic, and so forth? We answer, What has been already the cost of *laissez faire?* What was the cost in money, life, and war of the typhoid epidemic in South Africa? And, to come nearer home to the politician, what, for example, is the national cost, well expended we gladly admit, of the profession of the Law? To what do the well earned salaries of lawyers amount, taking those only from—say—£1,200 to £5,000 a year?—not to mention the still greater offices? The salaries of medical officers of health including the highest, do not average £800 a year; yet in hours of work, subject matter, professional education and range of knowledge in daily use, the function of the Medical Officer is surely larger and more exacting than of a Stipendiary Magistrate or County Court Judge. The truth is society has long taken its law, as being the more obvious function, for granted. Robbers came out of the neighbouring forest, but diseases were as God pleased. The depth and powers of medicine the public has yet to learn and realize. Moreover medical men, innocent angels as they are, have given so freely of their best to the public that for them to look for payment, other than in after-dinner compliments, seems too worldly to be credible.

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SECTION OF MEDICINE.

WAR NEUROSES.

INTRODUCTION TO THE DISCUSSION.

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THE importance of the subject which I have the honour of introducing is obvious from the fact that in no previous war has there been such a vast number of men disabled by functional nervous disease. But in no previous war have such conditions existed; they are:

1. Unprecedented exposure to the continuous physical effects of high explosives and poison gas and to all the developments of scientific barbarism. Moreover, the periods to which men have been exposed to the terrifying effects of modern trench warfare have exceeded all previous records. According to my experience the most serious cases of war neurosis occurred in 1915 and 1916, when men were unrelieved for weeks and when they were continually on the defensive, out-manned and out-gunned. Such conditions are quite different from a war of movement.

2. The conscripted army has included all sorts and conditions of men, and we have now found out, by the immense number of soldiers discharged from the service as permanently unfit, what a large proportion of the male population of a highly civilized country possesses a neurotic or neuropathic predisposition. In 1917 it was calculated that one-third of the unwounded and one-seventh of the total discharges, including the wounded, were permanently unfit on account of functional nervous or mental diseases.

The War Office authorities recognize three forms of war neurosis—more strictly speaking, psychoneurosis—namely, shell shock, hysteria, and neurasthenia.

It is not my purpose to describe in detail the symptoms of these three affections, which frequently merge. It is my object to promote discussion regarding some of the debatable points.

"Commotio Cerebri" or "Shell Shock."

I will, then, first consider the question of shell shock. There is no doubt that this term was an unfortunate one, and led to a considerable amount of misconception. It was a very natural conclusion, at first, that men who had been exposed to the unprecedented stress of bombardment should suffer from *commotio cerebri*. But a great many men who have been returned as suffering from *shell shock* would have been more appropriately designated *shell shy*. It is extremely difficult to differentiate commotional shock from emotional shock, for both may be attended by a state of unconsciousness followed by hysterical or neurasthenic symptoms. Still, there is no doubt about it, men do suffer from commotional disturbance of the brain without any signs of injury on the body, and that they are the subjects of organic changes, due to the forces generated by the detonation of high explosives, especially when they are in enclosed places, such as dug-outs or narrow trenches, where the full effects of repercussion can occur. The proof of this is shown by the fact that the cerebro-spinal fluid, withdrawn by lumbar puncture, contains blood, macroscopic or microscopic, and it comes out under pressure and contains albumin. Moreover, the frequency with which rupture of the drum of the ear, deafness, labyrinthine changes, and voltaic vertigo occur shows that the forces generated by the explosion are sufficient to cause a commotion of the brain as severe as might be caused by an actual blow on the head by a sandbag.

Further proof has been forthcoming in the examination of the brains of two cases in which no visible signs of injury were found on the body, and in which I found microscopic haemorrhages throughout the brain, including the medulla. In one case the man died suddenly from heart failure; there was a haemorrhage in the median raphe of the medulla close to the nucleus of the vagus accessorius; there was also a haemorrhage in the lung. Had there not been fatal cardiac syncope, there was no reason why he should not have recovered without showing any gross nervous symptoms. By this I mean to say that a number of cases of true shell shock suffer with minute haemorrhages insufficient to cause any permanent neurological symptoms, and their importance is rather as expressing a severe commotional disturbance caused by the explosive forces. Mairet and Durant have shown experimentally on animals similar minute haemorrhages in the brain and the lungs; likewise Crile.

The Inborn & Acquired Emotivity as a Factor in Psychoneuroses.

A soldier who has an inborn or acquired emotivity will sooner or later suffer with a psychoneurosis. A shell bursts near him, he sees the flash, is blinded by it and remains functionally blind; or some poison irritates his eyes and he is affected by a continuous blepharospasm. He hears the explosion and is temporarily deafened by the noise, and remains deaf. He is blown up, and perhaps falls heavily on the ground, or is buried with earth in a crater or dug-out, or a sandbag hits him. When he recovers consciousness he may be affected with a spasmodic tic or convulsive movement of a defensive nature, such as the dodging-reflex; or he may be affected with one of the many forms of hysterical tremor, paralysis or contracture. These varied and multiform hysterical manifestations are psychogenic in origin and due to emotional shock. They are curable by contra-suggestion. In true shell shock with hysterical symptoms there is always a residual neurasthenic condition which does not yield to persuasion.

When the physical forces generated by the explosion are sufficient to cause physical shock as well as emotional shock, the case is then complicated by two factors, the commotional and emotional.

The Army Form W. 3,436, which accompanies the evacuated soldier, gives information as to whether the shell burst so near him as to justify the assumption that commotion was the essential agent in the cause of the symptoms for which he was evacuated. This would be strengthened by the fact that he was unconscious or so dazed as the result of the shock that he either had to be carried or taken to the clearing station—especially would it be justifiable to classify the case as a *battle casualty* if he were buried and had to be dug out, or suffered contusions as a result of having been blown up.

Still, many facts show that individuals with an inborn or acquired emotivity can suffer so severely from emotional shock as to be rendered unconscious or so dazed as to necessitate them being taken or carried to the clearing station. It is therefore extremely difficult to decide from the symptoms alone whether the case is commotional or emotional or both. The only way to decide is by a careful investigation of all the facts, notably the length of time the man has been on active service at the front, and his conduct as a soldier prior to the occurrence of the shock. Another important piece of evidence is the loss of consciousness. The period of time varies from a few hours to a few days in the most severe cases.

Quite early in my experience at the neurological section of the 4th London General Hospital I found that the war neuroses and shell shock cases had, in the majority of cases, an inborn or acquired disposition to emotivity. The same conclusion was arrived at by eminent French and German authorities. Captain Wolfsohn, U.S A.M.S., investigated the personal history and the leading nervous state of 100 of my cases of war psychosis and 100 cases of wounded, and he came to the same conclusion.

No New Nervous Disease in War Neuroses.

The war has produced no new nervous disease; it is the same hysteria and neurasthenia which neurologists knew before the war and which were curable by the same methods. A fact which has been brought home to all those who have had the care of war psychoneuroses is

that the signs and symptoms of hysteria and neurasthenia of men who have been to the front and have been invalided home (except those in which there has been definite evidence of cerebral or spinal commotion or concussion, burial or gassing) in no way differ essentially from the signs and symptoms of hysteria and neurasthenia of soldiers who have never been out of England.

I have seen both hysteria and neurasthenia arise from the fear of conscription, or having been conscripted an hysterical crisis, contracture or paralysis has occurred when it became known that the conscript would be in a draft for general service abroad.

Inoculation has been followed by hysterical paralysis. I may mention one case which was recently sent to me. He was inoculated in March, 1915, and a quarter of an hour after he lost the use of his legs. He was sent to various hospitals and had brine baths. He was then boarded out of the army and received a pension of £2 12s. per week for himself, his wife, and family. He was sent to me by the Chelsea Pensions Board, arriving with crutches and a contracted knee. He was induced to walk in half an hour, and in a week was discharged cured.

I have observed that hysterical manifestations, especially mutism, paralysis, and contractures, are much more frequently met with in the men than in the officers. The latter more often suffer with an anxiety neurosis.

Severe Shock may induce Hysterical Manifestations in a Neuro-potentially Sound Individual.

The great importance of the inborn or acquired neuropathic tendency in the production of the symptoms and signs of hysteria and neurasthenia cannot be over-emphasized. At the same time it must be admitted that shock—and by this I mean not only commotional but the emotional shock—due to terrifying or horrifying conditions of this war, may induce hysterical manifestations in a neuro-potentially sound individual, in fact, in a soldier who by his record has shown that he is neither of a timid disposition nor has any neuropathic tendency.

Automatism and somnambulism, like the hypnotic state, is caused by a dissociation of the field of consciousness from perceptual stimuli, and is regarded as a characteristic symptom of hysteria. Indeed, Janet bases his definition of hysteria on this dissociation. Yet cerebral commotion, caused by the bursting of a large shell, may, as the following case shows, bring about in a neuro-potentially sound individual a condition of automatism—a state which Maurice Dide terms "battle hypnosis."

A captain was admitted under my care, and gave the following history. His company had dug themselves in, in a wood; he went out into the road to see if a convoy was coming, when a large shell burst near him. It was about 2 o'clock in the morning and quite dark; about 4.30 a.m. it was quite light, and he found himself being helped off a horse by two women who came out of a farmhouse. He had no recollection of anything that happened between the bursting of the shell and this incident. It is interesting to note that it is possible for him to have inhaled noxious gases, for the single cigarette in a metal case that was in his breast pocket was yellow on one side, due, no doubt, to picric acid contained in the explosive, which indicates the near proximity of the exploded shell.

Again, hysterical contractures and paralysis may arise as a result of shock in which there is commotio cerebri associated generally with emotional disturbance.

I have recently cured an acro-contracture of the hand of a young officer who suffered with shrapnel wounds of the left forearm and hand in May, 1915. This officer at the time of the injury lost consciousness, and when he came to he found the contracture. It has persisted ever since. Once the hand was opened under an anaesthetic, but the contracture returned almost immediately. He has been out to France with the contracture, and is in no sense an hysterical subject, but possesses all the qualities of a good soldier.

FUNCTIONAL PARALYSES AND CONTRACTURES.

The more important and evident manifestations of hysteria are those which provide the patient with a means of escape from an intolerable situation. These have been called by MacCurdy "conversion hysterias"—a useful term, as it represents a well recognized fact, that the motor and sensory disabilities are due to an idea being translated into a physical symptom. The paralysis or contracture may come on immediately after the shock, but is usually emotional; or it may come on after a period of meditation.

There may be three stages in the development of hysterical paralysis and contractures:

1. Often pain caused by injury induces an instinctive reflex defence reaction of immobilization of the affected part.
2. Psychogenic, in which the mind reacts and the idea is developed that the disability will relieve the individual from a situation which he fears—namely, return to the front.
3. Late phenomena of prolonged immobility—namely, disuse, wasting of muscles, fixation of joints, associated with vasomotor, thermal, and secretory disturbances.

Babinski's Theory of Reflex Contracture.

Babinski and Froment prefer to keep the term "functional" for those motor disorders which can be cured by psycho-therapy, and they put in a special category reflex contractures and paralyses arising in consequence of a wound or traumatism, which, without showing the characteristics of motor organic disease, can be distinguished from functional disorders by the absolute inefficacy of physio-psycho-therapy. They state, moreover, that these reflex disorders may be distinguished from hysteria by the following signs:

1. Vasomotor disturbances, often occupying the whole of the affected limb, or a segment of it—namely, cyanosis, blue markings, salmon red coloration.
2. Local hypothermia of a more intense degree than in hysteria.
3. Muscular atrophy; moist skin, sometimes even of a macerated appearance; rarefaction of the bones revealed by *x*-ray examination; muscular hypotonus at the level of certain articulations; mechanical hyperexcitation of the muscles corresponding to modifications of electrical excitability; disappearance of the contracture under profound anaesthesia; and, in deep anaesthesia after the extinction of all the other reflexes, a clonus of the patella may be induced in the affected leg.

The general trend of opinion now is that Babinski's theory will fall to the ground—that all these conditions which he asserts cannot be cured by physio-psycho-therapy and which he believes are due to reflex influence on the spinal cord, or to the sympathetic nervous system, can be produced by prolonged immobilization of a limb.

A case recorded by Roussy was the first to throw doubt upon Babinski's theory, for his patient suffered with all the vasomotor, secretory, and other disturbances which Babinski points to as characteristic, yet these disappeared after the patient's limb had been rendered mobile by physio-psycho-therapy.

For some time past a large number of cases of soldiers and pensioners suffering with wounds associated with prolonged functional immobility have been treated successfully by Captain Golla and myself. They may be divided into three classes: (*a*) Wounds, without an injury of nerves, associated with functional paralysis or contracture, many of long duration, even years. (*b*) Gunshot wounds with injury of nerves associated with organic and functional paralysis or contracture. (*c*) Wounds of nerves causing organic paralysis and contracture.

My opinion is that a wound associated with a purely functional paralysis or contracture is more difficult to cure; and in such a case this difficulty is due not to a reflex mechanism, but to the continuous suggestion which a wound offers to the mind of the patient that the disability is due to it—especially when this has been steadily reinforced by doctors and pension boards, who have regarded the wound as the cause of the paralysis or contracture.

Hundreds of functional cases, with and without wounds, have been admitted to the Maudsley Neurological Hospital and have been cured by Captain Golla or myself in a few minutes to a few hours, a few hours to a few days, or a few days to a few weeks, although some of the cases of paralysis or contracture have persisted many months or even several years. Occasionally a case has occurred of a wound in which a nerve has been involved—for example, the median, and a partial functional contracture has resulted ("main accoucheur") which did not disappear under deep anaesthesia. Myogenic changes must have taken place.

THE PSYCHOLOGY OF FEAR IN RELATION TO NEURASTHENIA.

In comparing the prolonged trench warfare of 1915–17 with the war of movement of more recent date in relation to the production of war neuroses, we are able to consider the biological aspects of various defensive reactions for self-preservation and racial preservation.

The instincts connected with the emotions of fear and anger are all-important, but the herd instinct is equally so, for morale, good or bad, in a regiment is largely dependent upon the instinctive suggestibility of man. A British general is reported to have said that "10 per cent. of a regiment will follow you to the gates of Hell, 10 per cent. will fall down or run away, and the remaining 80 per cent. will follow either." We may, therefore, suppose that in 10 per cent. the primitive emotion of anger, with its instinctive reactions, was an inborn dominant feature in the personality, and to fight was the instinctive reaction of self-preservation. In 10 per cent. fear was a dominant feature, and the instinctive reactions were flight or concealment. In the remaining 80 per cent. it may be supposed that the primitive emotions are fairly equally represented; consequently they tend to follow either. Given a good leader in a war of movement, the excitement of battle will arouse in them all the instinctive reactions of anger, so well portrayed by Shakespeare (*Henry V*, Act III, Sc. 1), and quoted by Darwin in *The Expression of the Emotions*. In modern trench warfare anger is impotent; the soldier can neither fight nor take refuge in flight; he can only adopt the crouching attitude of immobility and concealment—the instinctive reaction of a timid animal when threatened with danger. Darwin writes:

> The frightened man at first stands like a statue motionless and breathless, or crouches down as if to escape observation; the heart beats quickly and violently, so that it palpitates or knocks against the ribs; the skin becomes pale, due to constriction of the small arteries of the skin; perspiration exudes from it. This exudation is all the more remarkable as the surface is then cold, hence the term "cold sweat." The superficial muscles shiver, the breathing is shallow and hurried; the salivary glands act imperfectly; the mouth becomes dry. One of the most marked symptoms is the trembling of all the muscles of the body, and this is often first seen in the lips. From this cause and from the dryness of the mouth the voice becomes husky or indistinct, or may altogether fail. *Obstupui, steteruntque comae, et vox faucibus haesit.* (Darwin, *Expression of the Emotions*.)

Adopting this description of the fear reaction to the case of a man in the trenches who cannot adapt himself to the situation, he will suffer with continuous organic changes, the result of the emotion acting on the autonomic centres.

These organic changes and biochemical changes produce by repercussion profound effects on the mind and its affective tone. The psychologist James says:

> "Our natural way of thinking about these coarser emotions is that the mental perception of some fact excites the mental affection called Emotion, and that this latter state of mind gives rise to the bodily expression. My theory, on the contrary, is that the bodily changes follow directly the perception of the exciting fact and that our feeling of the same changes as they occur is the emotion." Again: "If we fancy some strong emotion and then try to abstract from our consciousness of it all the feelings of its bodily symptoms, we find we have nothing left behind."

Applying James's premisses to the psychology of fear in relation to the symptoms of war neurosis, I put forward this proposition for discussion: that inasmuch as the terrifying experiences remain continuously operative in the subconscious mind long after they happened, as shown by the frequency and persistence of terrifying dreams and many of the bodily reactions of fear already described, are we to assume that the organic reactions excite the dreams or that the imagination provokes the physical reactions?

Dreams and their Effects.

It does not follow that, because a patient does not recollect his dreams, his subconscious mind has not been active. There are many facts that prove the contrary. Ideas in sleep may be clearer and broader even than in the waking state, for a man in such times is not sensible of his body. In the dreams of soldiers, ideas of past war experiences are revived with great vividness in the great majority of cases, even in those who are unable to recollect their dreams. For besides those patients who wake up in a fright and cold sweat, there have been numerous instances of soldiers who have walked in their sleep, and many others who have talked, shouted out orders, and cried out in alarm as if again engaged in battle (not a few of these have been mutes). But the strangest phenomena of forgotten dreams of soldiers suffering with shock are observed in those who in their sleep act as though they were engaged in battle, and go through the pantomime of fighting with bombs, with bayonet, with machine gun and with rifle, and yet remember nothing of these happenings when they awake. Evidently during their sleep vivid imaginings of their previous experiences are arousing defensive and offensive reactions in face of the imaginary enemy.

I explain the fact that the neurasthenic, who so frequently suffers in the early morning with symptoms of nervous exhaustion and irritability, owes this condition to the exhausting effects of dreams which he may or may not recollect. Such an effect wears off as the day advances.

We can understand how the effects of commotion, burial, gas poisoning, and the profound emotional effects of horror at seeing comrades blown to pieces, or terror at the fear of impending death, may conspire to produce a condition of shock followed by neural exhaustion of the higher controlling centres and a continuous emotional excitation of the subconscious centres, due to the revival of past experiences. Whether we accept the James–Lange theory of the emotions, that the organic bodily changes of the emotion of fear reverberate in the mind and serve to arouse the feelings, or the theory of the perceptual feeling of fear preceding the organic changes—at least, we must admit the existence of a vicious circle. In support of the theory of an organic disturbance reviving a terrifying experience, we are familiar with the fact that an indigestible supper will cause nightmare.

Objective Signs indicative of Bodily Changes in Neurasthenia of Soldiers.

What is the evidence in favour of persistent bodily changes occurring in soldiers suffering with shell shock neurasthenia, especially when trench warfare was taking place?

A large number of soldiers were admitted under my care suffering with severe neurasthenia; about 10 per cent. showed some symptoms of Graves's disease, palpable thyroids, exophthalmos, von Graefe and Möbius signs, fine tremors 9 to 10 per second (indistinguishable from the neurasthenic tremor), tachycardia, acrocyanosis, hyperidrosis, and hyperacusis shown by the starting reflex.

In many cases the blood pressure was higher than normal, especially in cases where there was an anxiety neurosis. There were indications, therefore, of an increased amount of adrenalin in the blood, as there was undoubtedly an increase of thyroid secretion in many of the cases.

Crile, in his lecture on the *Kinetic Drive*, asserts that there is an interrelation of function of the medullary adrenalin substance—the thyroid and the brain. "Environmental stimuli reach the brain and cause it to liberate energy, which in turn directly or indirectly activates certain other organs and tissues, among which are the thyroid and adrenal glands." The resemblance in the facial expression between chronic emotional activation and Graves's disease, and the frequency with which this disease is traced in civil life to an emotional origin, point to the conclusion that the fear-affect is still operating in these war neuroses. As the dreams become less troublesome and give place to natural sleep—"the sweet, unconscious quiet of the mind"—so these symptoms disappear, the blood pressure falls, the pulse slows, and the other bodily changes mentioned disappear. That the increased secretion of adrenalin in the blood occurs as a result of fright has been shown experimentally by Canon and Elliott. This may be regarded as a biochemical defensive mechanism for self-preservation, for it raises the blood pressure and causes an increased quantity of glycogen to be converted into sugar—the energy substance of the muscles—thus enabling the animal to prepare for fight or flight. This is effected through the stimulus of the autonomic centres in the medulla and the splanchnic nerves. May not also the increased activity of the thyroid be regarded as a biochemical defensive action to restore the exhausted neurons?

Changes in Central Nervous System in Hypothyroidism.

It is well known that hypothyroidism is associated with slowness of thought, of speech and of volition; and I have shown in a number of cases exhaustion of the neurons in myxoedema. The chromatolysis of the nerve cells in advanced cases is most pronounced throughout the central nervous system. If we regard this stainable substance as representing kinetoplasm or energy substance of the nerve cell, we may consider this an explanation of the symptoms of the disease. It seems highly probable, inasmuch as these neural symptoms disappear with the administration of the thyroid gland.

MacCurdy noticed—and I can corroborate this—that in cases of war neurasthenia there is a profound effect upon the sexual organs—sexual desire is largely in abeyance, owing to the preponderance of the emotions connected with the instinct for self-preservation. This fact is also noticed in Shakespeare in Lady Percy's speech to Hotspur (*Henry IV*, First Part, Act II, Scene 3).

Influence of Body on Mind.

Many cases of neurasthenia suffer with profound disturbances of nutrition, and grave alterations of the personality are connected with changes of nutrition and metabolism. The individual feels depressed, and the success of the Weir Mitchell treatment depends, not only upon the effect of isolation upon the morale of the patient, but upon the restoration of normal nutrition of the body, thereby the restoration of neural energy.

In fact, while fully admitting the importance of psychotherapy and its great success in hysteria, I feel that in the case of neurasthenia, brought about by war stress, it is equally necessary to treat the disordered functions of the body.

I am reminded of a story told of Voltaire and an Englishman. When both were feeling very depressed they entered into a compact to commit suicide the next day. The Englishman appeared the next morning, and Voltaire is said thus to have addressed him: "Ah, Monsieur, pardonnez-moi, j'ai bien dormi; mon lavement a bien opéré, et le soleil est tout-a-fait clair aujourdhui." Its moral is the influence of the body on the mind.

Suggestion: its Influence on Body and Mind.

Suggestion, or the affective relation of the doctor to the patient, is considered usually only in regard to its curative influence. But, according to my experience, injudicious suggestion unfortunately is not uncommon, and has the converse effect. Take, for example, the neurasthenic who is suffering with cardiac symptoms, who is diagnosed as suffering with D.A.H. (disordered action of the heart). The patient's mind thereby dwells upon his heart and its disordered action: it becomes an anxiety to him. While this is so, the heart's action will remain disordered. It would be better if this term were abolished and simple neurasthenia adopted in its place. Every organ and structure in the body is represented in the field of consciousness, but the stimuli arising from them only arouses consciousness of their existence when they are above or below normal intensity, or when their rhythmical, phasic, or periodic character varies from the normal.

The consciousness of the existence of an organ or structure interferes with its normal automatic or habitual actions.

The sense of well-being, of *joie de vivre*, depends upon normal organic sensibility, especially upon the normal action of the heart, expressed in Shakespeare thus:

> My bosom's lord sits lightly in his throne,
> And all this day an unaccustomed spirit
> Lifts me above the ground with cheerful thoughts.

I have dwelt upon the organic side for the express purpose of promoting discussion and not because I do not regard psychotherapy as an important agent in treating the functional neuroses, but I am of opinion that it is especially valuable in hysteria, or as Babinski prefers to term it, pithiatism—meaning curable by persuasion. The methods adopted are somewhat different in the different schools; but they all aim at the same end. One fact I should like particularly to emphasize, and that is, the necessity *in all cases* of making a thorough clinical examination. And for two reasons: it inspires confidence in the physician that he is dealing with a functional and not organic disease, or an organic disease with a halo of functional disturbance; it also inspires confidence in the patient, for he will reason that "the doctor has made a thorough examination, and if he assures me there is no organic disease, I must listen to his persuasion."

To make a diagnosis requires a sound neurological training. The personality of the doctor and the establishment of an atmosphere of cure plays an all-important part in inspiring faith in the patient.

Psychotherapy.

Bernard Hart in a recent instructive article points out that there are three methods of psychotherapy: (1) Affective therapeutics, a term which he prefers to suggestion; (2) persuasion, or the rational explanation of the symptoms to the patient; (3) analysis. The first two methods seek to eliminate the morbid condition; the third does more than that, it seeks to uproot the initial cause which led to the morbid condition.

Treatment of Functional Paralyses and Contractures.

Each case must be dealt with on its merits. Many physicians do not care to use faradism to reinforce persuasion; but this method of physio-psycho-therapy or other physical means of reinforcing suggestion and re-education I have employed with great success. It has several advantages: (1) You can show the patient that all his muscles contract when they are stimulated; (2) where there is functional loss of sensibility the application of faradism by the roller or brush will rapidly restore sensibility, and it may be employed successfully to remove functional tremors. It seems to me that it rouses the dormant consciousness in the brain of the affected part and directs voluntary attention, which is in abeyance, towards the affected part. I have found it especially useful in mutism and in aphonia. If it has been tried before and been a failure, some other expedient must be adopted, for the patient has lost faith in the method. For example, I have cured functionally paralysed hands that have been treated by electricity, by telling patients that their hands are cold and benumbed, and that the blood supply to the part is insufficient to excite the nerves, so they have lost consciousness of the hand; but, after it has been warmed by radiant heat, they will be conscious of it and be able to move the fingers.

Another method which I have found very useful to restore function by persuasion is to tell the patient to shut his eyes and repeat all the passive movements with the sound hand and arm which I am making with the paralysed limb. If he is able to do this, I tell him that there cannot be any break in the nervous paths to his brain from his hand, and that he only has to will the movement or assist me in the passive movements I am making to recover the power in them.

In some cases of functional paralysis, however, there is a complete loss of the kinaesthetic sense, and these cases are much more difficult to cure by suggestion. The great secret of curing these hysterical cases is time and patience at the first treatment and not to leave the case until either there is a material improvement or a complete cure. Otherwise the patient will lose faith; indeed, we must always have present in our minds the dictum of Charcot: "C'est la foi qui sauve ou qui guérit."

SECTION OF SURGERY.

DISCUSSION ON GUNSHOT WOUNDS OF THE CHEST.

OPENING PAPERS.

I.—Colonel T. R. Elliott, F.R.S.

The immediate anatomical results of a wound perforating the chest are familiar. The splintering of the ribs inwards and outwards, the laceration and bruising of the lung around the track of the missile, and the effusion of blood to form a haemothorax within the pleural cavity. But the changes, physiological and pathological, that are associated with these gross objective features of the wound are not yet fully comprehended, and it is important that every scrap of knowledge available on this subject should be collected so that the complete story may be constructed. Very few observations have as yet been published in

description of the progressive changes in physical signs and in the *x*-ray appearances during the first and second days after the infliction of a chest wound. Yet there must be an abundance of such observations stored away in the clinical notes made by medical officers during the hurry and pressure of active work. Surgeons, too, carry in their visual memory observations that may be of the highest value for theoretical discussion, and these should not be lost. It is chiefly with the hope of hearing such incidental observations in the course of this morning's surgical discussion that I wish to bring forward some points in pathology.

First, with regard to the reaction of the lung itself to the wound and to the presence of the subsequent haemothorax or pneumo-haemothorax. The lung tissue may be infiltrated with blood for a considerable distance around the wound track, but the lung is so elastic that it does not fissure and rarely shows contrecoup injury at a distance from the wound. The changes in the pulmonary circulation are probably only those associated mechanically with the haemothorax, for the lung vessels lack a powerful vasomotor innervation.

But the bronchial airway is enveloped by a complete muscular coat right down to the openings of the smallest bronchioles on the infundibula, and this muscle coat can be directly relaxed or constricted by nervous impulses so that the airway is opened freely or almost closed. In the guinea-pig this muscle layer is so powerful that, as shown by Dale's experiments on anaphylactic death, it is capable of a cramped constriction in response to an injection of eggwhite that will kill the animal straightway by sheer asphyxia. The study of irritant poison gas at the War Office experimental ground at Porton revealed a strong constriction of these bronchiole muscles in goats, when exposed to an atmosphere of phosgene or of chlorine.

What happens in man is still unknown, though there is good reason to suppose that this bronchial musculature plays its part in many reflex reactions to injury. Even the normal physiological activity of the muscle is still obscure. It has a changing activity, but no one quite knows to what end or purpose. The muscle grips its tightest on the airway at the narrow inlet to the air sacs, where bronchitis ceases and pneumonia begins; but it is unlikely that it has a chief function in controlling the ingress of infection, and it is more probable that its main purpose is that of protecting the elastic tissue of the air sacs from harmful overdistension.

Let us assume that this musculature is thrown into strong contraction throughout the lungs as the usual reflex reaction to a chest wound. Cyanosis and dyspnoea would result, not a reaction of obvious utility, but one that none the less is generally observed. Rest for the wounded man, and morphine, help to allay this difficulty of breathing, and in a few hours the casualty has generally regained a fair colour and will stand an operation well. The chest feels free for breathing, and the cyanosis has vanished.

But occasionally this wished for change does not appear. Though there is no great accumulation of blood or of air in the pleural cavity the cyanosis and discomfort persist, and the surgeon has learned by experience that patients in such a state stand an operation on the chest very ill. Major K. D. Wilkinson, in his paper with Colonel Gask, differentiated this group, and he characterized it by cyanosis, dyspnoea, and "inspiratory retraction," or sucking inwards, of the lower intercostal spaces on the side opposite to that of the wound. This must be a condition that affects both the lungs. The local reflexes interfering with respiratory movements on the wounded side, or the effusion of a moderate haemothorax, do not appear to cause cyanosis, nor do they render thoracotomy dangerous.

It is fair to assume that the state is caused by a prolonged reflex constriction of the bronchiolar musculature which damps down the air current. The lung, despite its elastic tissue, would under these conditions remain virtually inelastic, because the air could not pass easily in and out. Instead of the lung being enlarged and sucked out by inspiration, the intercostal spaces would conversely be sucked in. This phenomenon is actually seen to occur, the lung behaving as though it were semi-rigid and small.

At this point it is necessary to consider the effects upon the lungs of the respiratory movements that are observed after a chest wound. The respiration is shallow and quickened, with a small air current. On the injured side the intercostal muscles are said to show an increased tone, "guarding the wound within," while their respiratory rhythm is often lessened to almost complete immobility. The rhythmic movements of the diaphragm are certainly lessened too, but the tone of the muscle does not seem to be increased, for the *x* rays a few hours after the wound show that it is in a position of extreme elevation, that is, of relaxation in the complete expiratory phase. I do not know how early this position is assumed, but the *post-mortem* specimen on exhibition proves that it is assumed at an early time, and that it may then be rendered more or less permanent by light adhesions to the thoracic wall. This reflex cessation of *inspiratory* activity of the external muscles of respiration will have the same effect as the hypothetical constriction of the bronchiole muscles would have, and the air current is lessened by it.

Here we are left to pure speculation, which requires to be checked by observed facts; and these, in my own experience, are scanty. The outstanding characteristics of a haemothorax, which differentiate it from an ordinary pleural effusion, and must therefore have relation to some peculiar results of the actual wound of the chest, are the elevation of the diaphragm, the small size of the chest, and the tendency to partial or complete collapse of the lung in any area; while later the part of the lung on the wounded side which is not submerged in the haemothorax shows an unusual compensatory emphysema. The lung tends to be small on the wounded side, and to collapse everywhere.

Sir John Rose Bradford, in his recent paper in the *Quarterly Journal of Medicine*, emphasized this curious retraction of the chest as being indicative of a collapsed condition of the lung frequently following chest wounds, and, partly following Pasteur's original view of "massive collapse," he explained the general characteristics of a haemothorax with pulmonary collapse by assigning them to an external compression caused by the retraction of the chest wall and by the immobility of the diaphragm in an extreme expiratory phase.

It is true that the chest wall does not simply follow the size of the lung within, and that the thoracic muscles do independently assume an immobility and possibly a rigidity like that of the abdominal muscles after an intraperitoneal injury. But the lung itself has its physiological reflexes, and it is not a passively elastic bag. The smallness of the lung might be equally explained by an associated constriction of the bronchiole muscles, cutting off the diminished air current from the alveoli. The diminution of the air current, which results from the lessened inspiratory activity of the external muscles of respiration, must also be recognized as an important point in the discussion; for otherwise the lung would not of necessity become smaller from constriction of the bronchioles, and, indeed, it might be overdistended, as is seen in the guinea-pig's death from anaphylaxis.

When once these conditions are established the air in the air sacs, nitrogen as well as oxygen, is rapidly absorbed into the circulation, and hence large areas of the lung may be completely deflated. General massive collapse of the lung on either side after a chest wound is rare; and, as recognized, its only practical importance is that it is a contraindication to early operation. Smaller areas of collapse do occur, though with nothing like the frequency that has been estimated by some writers. In *post-mortem* examinations of cases with wounded chests, Captain Henry and I occasionally found this change to be present in the base of the lung opposite to the haemothorax, though not nearly so often as pulmonary oedema or congestion, with which the condition was frequently confused by the clinicians in the interpretation of physical signs during life.

It was much most frequently seen in a triangular area occupying the middle sector of the lower lobe, with the base of the triangle resting upon the diaphragm. Such a distribution of the area of collapse could have no possible reference to the action or inaction of any external respiratory muscles alone, and must be determined by some factor within the lung itself. Dissection of a lung discovered the explanation. The main bronchus to the lower lobe divides into three branches which do not communicate with one another. We found by experimental inflation that the middle one of these branches supplied exactly that middle triangular sector in which massive collapse was seen to

occur; and this bronchus is unique in its anatomical relations, for it is crossed at right angles by the great branch of the pulmonary vein which runs forwards from the back of the lower lobe to join the main trunk at the lung's root. No lung tissue intervenes between the vein and the bronchus.

With a haemothorax on one side it is probable that the circulation soon dwindles in that part of the lung which is compressed and airless beneath the effused blood. Were it otherwise, the patient would show persistent cyanosis apart from effort, like that of a case of congenital heart disease. The rest of the pulmonary circulation will become correspondingly engorged, and therefore the particular vein to which reference has been made is likely to be distended and cause abnormal pressure upon the bronchus. If the latter is partially obstructed with mucopurulent secretion, or the airway otherwise embarrassed, it is conceivable that this extra pressure from without on the bronchus would cut off the air current completely. Then massive collapse would be bound to follow in all the area supplied by that bronchus.

The coloured drawing illustrates a case of massive collapse in this triangular area from a case of phosgene gas poisoning, in which there chanced to be reproduced the particular conditions that are usually associated with haemothorax. The effects of the phosgene had caused the main pulmonary artery on one side to be greatly obstructed by a thrombus on its inner wall, so that the vessels in the contralateral lung must have been engorged, just as with a haemothorax. There was thick mucopurulent secretion, half blocking the bronchus. The pressure from without and the secretion within combined to close the airway at this critical anatomical point, and collapse ensued. Such a result of a chance anatomical relationship is analogous to that with infratentorial tumours of the brain, where Harvey Cushing proved the paralysis of the sixth nerve to be caused by direct pressure from an artery crossing it at right angles.

The importance of this area of contralateral collapse is not its immediate clinical interest, for that is slight, but its reference to the general theory of collapse. Here is an area where anatomical chance has created circumstances tending to localize collapse, and, so to speak, to precipitate it down from a general condition throughout the lung. Collapse may occur in other areas, and it may even involve an entire lung. The view that to my mind embraces the whole state is that of a general reflex bronchiolar constriction, which prepares the lung for collapse when the external respiratory movements are inadequate. And this theory might be used to explain the excessive emphysema, with its skodaic phenomena, that develops subsequently in a lung above a haemothorax; for it might be assumed that the preliminary constriction of the bronchioles is followed by a phase of extreme relaxation which may favour the development of emphysema.

The view, however, is little more than a hypothesis that cannot be developed further until more evidence is accumulated as to the actual condition of the chest soon after a wound. We need more observations on the presence or absence of early cyanosis, on the precise activities of the thoracic muscles and of the diaphragm in those early hours, and especially in those cases which felt "winded" after their wound.

Knowledge of the action of the bronchiole muscles is much needed for general medicine, and it is important that surgeons should bring forward from their own observations on wounded chests evidence to decide whether the above hypothesis is true or false. But in discussing this question it should be remembered that all the reflex conditions established in a wounded chest are liable to rapid alteration when the thorax is freely opened by the surgeon. Every one has noticed how an immobile diaphragm will then pass into vigorous activity.

The practical gain for surgery in the recognition of such a reflex state might be the power to control by drugs such a bronchial constriction, and so to bring dangerous cases within the reach of a successful operation.

Haemothorax.

The questions that arise with regard to haemothorax are chiefly practical ones dealing with the treatment of this intrapleural collection of blood, either when sterile or infected.

I think that the view of the coagulation process which Henry and I put forward remains generally accepted, namely, that the effused blood very rapidly passes through the clotting process, but that the coagulation is interfered with by the respiratory movements so that the fibrin is to a considerable extent whipped out of the blood. Very rarely does an entire massive clot form. Sometimes the fibrin is completely separated, leaving a fluid blood, red, non-coagulable, and full of corpuscles. Usually the process is of an intermediate type, and lumps of jellied clot are deposited on the pleural surfaces or lie away in the pleural recesses. The pleural membranes then react by a mild inflammation to some constituent or other of the haemothorax, even when it is sterile. There is an outpouring of pleural effusion containing more fibrinogen, and the clot on the lung surface is thickened and organized.

The fluid mixture of whipped blood and pleural effusion can at any time be withdrawn by aspiration: the clot cannot. Moreover, where haemothorax clot invests the lungs it develops in process of time into a tough jacket which restricts the lung to the size at which it is for the moment confined, and hinders subsequent expansion when the fluid is removed. This fact may be inferred from measurements of intrapleural pressure after aspiration. It is proved by the specimen of which the drawing is shown.

Here a very large haemothorax had been caused by a shell wound through the lung apex. It remained sterile and was not aspirated. On the seventeenth day the patient died of haemorrhage from another source. At autopsy the haemothorax was found to contain much fluid blood, but the lung was completely coated with red clot. Inflation of the trachea by bellows easily blew up the normal lung, but the lung on the side of the haemothorax was with difficulty inflated to about one-half of its normal size. The clot was then stripped off with ease by a pair of forceps, and the lung after this liberation could be readily inflated, for it retained all its natural elasticity.

Clearly a large haemothorax should be removed as completely as possible and at the earliest date. If this is not done the compressed lung will expand imperfectly, and the patient will exhibit the progressive falling in of the side of the chest and the drooping of the shoulder that were studied at Taplow by Meakins and his colleagues, and his breathing will be inadequate for full work. Special physical exercises will slowly correct the fault and help to re-expand the lung, but earlier treatment could save these crippling after-effects that unduly prolong the time of invalidism.

When the haemothorax is chiefly fluid and with little clot an early aspiration will suffice, and the lung re-expands almost at once. Even on the second or third day this may be done, and there is neither recurrent bleeding nor much subsequent accumulation of fluid. These are now truisms, familiar to every one with practical experience; but, as mentioned earlier, long time was needed before the practice of early aspiration was admitted to be correct, and then it only came into use in spite of theoretical objections because several junior medical officers tried and proved to senior critics that the method was right.

This treatment is enough for any small-sized haemothorax, for even though the latter may chance to consist chiefly of clot, the inactivity of a relatively small area of the lung is not a serious matter, and the patient can take enough exercise to help his chest to work until the clot is absorbed. The majority of these cases are returned to duty within three months of the wound, whether they were aspirated or not.

With a large haemothorax the correct line of action is open to debate. In the first place, it is difficult to be certain that clot is present, and more than one failure in an attempt at aspiration is required before the conclusion can be permitted that the failure is due to excess of clot. When the proof is satisfactory, then it is right to open the chest and evacuate the haemothorax, closing all again completely and never attempting any drainage. But even this surgical operation will fail to give a satisfactory result if it is so long delayed that the clot over the lung has time to be firmly organized, as in the specimen which I have demonstrated.

One is therefore driven to the obvious conclusion that a thoracotomy for evacuation of a large haemothorax

should be performed very early if it is to give a useful result. Shall it be a routine operation in all such cases? I think that most surgeons agree that this is not desirable so far as the haemothorax alone is concerned. Excellent results can, in most cases, be obtained by simple aspiration, and some statistics that I published in the *Lancet* eighteen months ago prove that such patients, even after a large haemothorax of three or four pints, often succeed in returning to the fullest efficiency of duty within three months of the wound. Colonel Gask will be able to quote similar figures showing the time of invalidism of men on whom he performed thoracotomy simply for the evacuation of the haemothorax. It is, of course, unfair to use the entire body of the figures in a close comparison, because cases vary so much in the amount of residual clot. But the main results in time of invalidism are alike for aspiration and for thoracotomy, if one sets aside from the results of simple aspiration those cases in which much clot was present, and therefore the ultimate recovery was slow.

The correct procedure for a *large* haemothorax would therefore appear to be this—and again I emphasize that here one is only considering the haemothorax in itself—that early aspiration must be the routine, and that if this is found to fail by reason of clot, then the chest must be evacuated at the earliest possible date by thoracotomy without drainage.

But the urgent problem with chest wounds in this war has not been that of improving treatment in order to abbreviate the time of consequent invalidism by a month or two. It was always that of checking the spread of infection, which was carried into the wound in so large a proportion of the cases. Half the total of deaths from chest wounds at casualty clearing stations, and all the deaths on the lines of communication, were caused by sepsis. Nearly half the cases of haemothorax that were caused by shell fragments went septic in the first year of the war, and a quarter of all cases of haemothorax went septic irrespective of the missile that had caused the wound. Out of the septic haemothorax cases 50 per cent. died under the average skill that was available in hospitals for their care. Those who survived, thanks to early detection and adequate drainage, were under hospital treatment for more than twice as long as the sterile haemothorax cases; and one-third of them were ultimately invalided out of the service, whereas practically every case of sterile haemothorax sooner or later got back to duty. And even these figures do not give the full measure of invalidism caused by sepsis, for they tell nothing of the time lost by prolonged suppuration from carious ribs in the chest wall, where the infection had not gone deeper.

This was the problem that surgery did at last solve. The thoracic wall is now closed and repaired by early operation, and the success of such measures often prevents infection from creeping inwards to the pleural cavity at a later date, as it used to do, particularly in the form of a dangerous streptococcal invasion. Far more than that. The surgeon opens the chest and directly deals with infected material lying within the haemothorax, and, removing it, arrests the spread of infection and the development of the dangerous empyema. The wound track in the lung is closed, and with the same happy result. For though a slightly lacerated and infected wound track in the lung can often take care of itself, so far as its own healing is concerned, infection introduced by the missile and not derived from torn bronchi may often escape from the injured lung, as the covering blood clot breaks down, and so spread backwards into the haemothorax. Pierre Duval with Vaucher urged this strongly, at a time when we in the British service were somewhat slow to recognize it, the French observers believing that many of the cases where delay had been noticed in the ultimate general infection of a haemothorax by anaërobic bacilli were due to such an escape of anaërobes from a focus implanted within the lung itself.

II.—COLONEL G. E. GASK, C.M.G., D.S.O.

SURGICAL ASPECTS.

THE great lesson that has been learnt in this war is a clear conception of the biology or evolution of a wound. It is now clear that nearly 100 per cent. of all wounds are contaminated. It is equally clear that there is a period of some hours between the time of contamination and infection; that is to say, before the organisms have had time to multiply and invade the tissues. If infection is allowed to take place the wounded man runs the risk of death or prolonged illness from septic processes. It has also been abundantly proved that antiseptics by themselves are of little value in preventing sepsis. The correct practice, whenever practicable, is to excise the wound in the latent period between contamination and infection, removing foreign bodies of all kinds. After this complete mechanical cleansing the wound should be closed and the patient kept at rest. If this method can be applied, then the percentage of healing by primary or delayed primary union is very high, and much needless death, suffering, and disability is saved.

The advance in thoracic surgery is due to the application of these principles to gunshot wounds of the chest.

Fears about Chest Wounds.

In the early years of the war little was done for patients suffering from these wounds beyond dressing or strapping the chest wound, propping the patient up in bed, and giving him some morphine and a cough mixture. Under this treatment it is true many recovered, but many died and many had a long and tedious convalescence. Our reasons for non-intervention were mainly three:

1. The experience of the South African war led us to think that chest wounds were best left alone. In that war conditions were different. Wounds were mostly due to rifle bullets, the climate was dry, and the soil relatively clean. In this war the missile was frequently a shell fragment and the soil was fouled with centuries of manuring. Infection, therefore, was the rule rather than the exception.
2. It was thought that it would be highly dangerous, if not fatal, to open the chest without some sort of pressure chamber or insufflation apparatus, which is too cumbrous for field work.
3. It was believed that opening the chest and handling the lung might provoke renewed and fatal bleeding. All these objections have proved fallacious.

Causes of Death.

The mortality from chest wounds was high. Apart from deaths due to complicating wounds the fatal cases, as they appear to the operating surgeon, fall into three main groups:

1. Deaths a few hours after admission to a casualty clearing station. These are generally due to extensive and severe injuries, combined with loss of blood and shock. Few only of these cases can be saved, though with the aid of improved resuscitation methods and transfusion of blood the percentage improved.
2. Deaths two or three days after the injury. These are almost always due to sepsis of the pleural cavity and its contents.
3. Deaths at the base. Sepsis is again the almost invariable cause.

Similarly, prolonged illness is almost always due to septic processes, usually empyema and its sequelae.

The irresistible conclusion is that the treatment must be directed towards elimination of infection in chest wounds as in wounds in any other part of the body, and that a contaminated wound of the chest will become an infected wound if not mechanically cleansed.

Channels of Infection.

Having found out that the preventable cause of death was essentially due to infection of the pleural cavity, it was necessary next to discover the channels of contamination. The pleural cavity may be contaminated:

1. By the missile and portions of clothing or equipment carried in with it. Indriven splinters of rib are a factor both of causing and maintaining sepsis.
2. Through the wound of the chest wall. A wound which leads directly into the pleural cavity and through which air is sucked at every breath will always lead to infection.

Further, even a small wound, through which air is not being sucked, unless cleansed by operation, may suppurate in the course of a few days, and unless the thoracic cavity has become sealed off by natural means organisms pass through into the pleural cavity, where they find the haemothorax fluid a good breeding ground.

3. From the wound of the lung itself in which the missile, bone, or piece of cloth may be retained.

There can be no dispute now that the duty of the surgeon is to: (1) Arrest haemorrhage, when necessary; (2) resuscitate collapsed cases; (3) when required, to cleanse the wound of the chest mechanically. In other words, the principles of surgery are to be applied to chest wounds as we have learnt to apply them to wounds of other parts of the body.

Types of Chest Wounds.

Chest wounds present themselves to the surgeon in the following categories:

1. Perforating or through-and-through bullet wound.
2. Perforating or through-and-through shell wound.
3. Penetrating wound with retention of large missile.
4. Penetrating wound with retention of small missile.
5. Open thorax.
6. Tangential parietal wound.
7. Thoracic wounds complicated by injury of the abdomen or spine or by multiple wounds.

Speaking generally, rifle bullets do much less harm than fragments of shell. They usually make a through-and-through wound, with small entrance and exit holes. Such cases very often get well of themselves.

Shell wounds, on the other hand, are far more dangerous. Shell fragments occasionally cut a track with entrance and exit wounds of the same size. More often they have an explosive effect, the exit wound being considerably larger than that of entrance. The fragment entering carries with it portions of clothing or equipment, which lodge in the pleural cavity or contents. At the same time splinters of bone are driven in, and may be found scattered along the track of the missile.

The effect on the lung is considerable. Collapse of the lung is almost invariable, often to half or less than half its normal size. Bleeding at first must be free, for a haemothorax is almost always present. It is fortunate, however, that unless a large vessel is hit, bleeding is controlled automatically by the collapse of the lung.

If a through-and-through track is slit up it is found to be ragged, lined with tags of tissue and destroyed parenchyma. Around the track is an area, often extensive, infiltrated by blood. This area is sometimes dense enough to be seen by *x* ray.

Surgical emphysema is common both in the parietes, in the mediastinum, and in the lung itself. Substernal emphysema is responsible for many queer noises, which may be mistaken by the unwary for pericarditis.

Study of the pathological anatomy of chest wounds shows us, therefore, that they have the same characteristics as other battle wounds. They can also be treated in the same way—that is to say, if before infection has occurred the dead and dying tissues are cut away, the foreign bodies removed, the blood cleaned out of the pleural cavity and the chest closed, then in a great majority of cases healing will be by primary union; the wounded lung will expand, and normal function be restored early.

CLINICAL APPEARANCES.

Initial Distress.—A man hit in the chest shows as a rule considerable distress, owing to the sudden upset of the respiratory and circulatory mechanism. If the injury is not too severe, and the wound of the chest wall closes automatically, the patient is able to accommodate himself to this upset. If the wound in the chest wall is large and open, and each inspiration allows a rush of air into the pleural cavity (open thorax), the distress is great and continuous. Such a condition, unless treated, is always fatal, either immediately from collapse or later from sepsis. An open thorax should always be closed at once by the insertion of temporary sutures, and then transferred to the hands of the operating surgeon as soon as possible.

Haemoptysis.—It is usual for the man to spit blood immediately after being hit. Haemoptysis is common for several days later, but is rarely of importance. If a large vessel has been hit the wound is almost immediately fatal. On arrival at a casualty clearing station it is common to find the patient suffering from shock. This may be due to the severity of the wound, loss of blood, pain, upset of respiratory and circulatory mechanism, cold and fatigue, or jolting of transport. All or some of these factors may be operative.

PRINCIPLES OF TREATMENT.

Physical Examination.—When a patient is admitted suffering from a chest wound he should be put to bed and allowed to rest undisturbed for one or two hours to recover from shock. The two exceptions to this rule are when (*a*) there is active bleeding, (*b*) a sucking wound. Later a survey of the whole patient must be made and all wounds examined. Evidence of haemothorax, pneumothorax, or collapse of the lung are to be sought for. Movements of the chest may reveal much and the position of the heart is of importance. The whole body should be searched for complicating wounds, especially with regard to abdominal and spinal injury.

X Rays.—Radiography is of the greatest importance, for with its aid valuable information can be gained concerning: (1) The position and size of a foreign body; (2) the existence and size of haemothorax and pneumothorax; (3) the condition of the opposite lung, cardiac displacement, and movements of the diaphragm. It is to be noted that screening of a patient reveals more than a plate, and if possible the screening should be done in the sitting position. In the British Expeditionary Force this was usually impossible. Also our *x*-ray plant did not allow us to recognize the existence of indriven splinters of bone.

Resuscitation.—It is not necessary to say more than that all the approved methods of resuscitation must be used in order to bring the badly wounded up to such a condition that they can stand operation.

Indications for Early Operation.—These are:

1. A ragged wound of the soft parts.
2. Compound fracture of the ribs.
3. Continued bleeding, whether from the inside or out.
4. Suction of air into the pleural cavity (open thorax).
5. Retention of a large foreign body.
6. Pain—out of proportion to the apparent severity of the injury (often the result of indriven splinters of bone scratching the lung with every respiratory movement).
7. Rapidly increasing pneumothorax, due to a valve-like opening into the pleural cavity, which allows air to be sucked in and prevents its expulsion (valve pneumothorax).

Indications for Non-interference.—When none of these indications is present—that is, when the wounds of the chest wall are small and clean, when the foreign body retained in the lung or mediastinum is small and there is little likelihood of septic changes—then the patient may be treated on general medical principles. The wounded man is kept in bed propped up or flat as he prefers, and a careful record is kept of pulse, respiration and temperature, in order to recognize the possible advent of septic changes in the haemothorax fluid. Further, blood may be drawn off from the pleural cavity by aspiration, repeated when necessary.

Treatment by Operation.

Time of Operation.—The best time is as soon as possible after the patient has recovered from the initial shock.

Choice of Anaesthetic.—Patients bear operation well and take a general anaesthetic satisfactorily. The French commonly use ether, the Americans gas and oxygen, the British either chloroform or local anaesthesia. It would appear, therefore, that the form of anaesthesia is not of great importance as long as it is administered skilfully. It is certain that under general anaesthesia one side of the chest can be opened without danger of respiratory failure, except when there is damage or collapse of the opposite lung, as evidenced by inspiratory retraction of the chest wall.

Objects be be Aimed at.—These are:

1. Excision of the wounds of the soft parts.
2. Excision of the broken bones—ribs or scapula.
3. Cleansing of the pleural cavity from blood, missile, indriven fragments of bone, or clothing.
4. Excision (when possible) of the damaged area of lung.
5. Suture of the lung.
6. Closure of the thoracic cavity.

The operative procedure will be considered under these headings.

Excision of the Wounds of the Soft Parts.

If nothing further be done, wounds of the soft parts, unless small and clean (for example, rifle bullet wounds), should be excised, because otherwise they become infected, and organisms may spread along the track of the missile into the pleural cavity, giving rise to empyema.

Excision of the Broken Bones.

Excision of the wounds of the soft parts leads the surgeon to the ribs. More often than not the ribs or scapula are broken, and, whether or not further operative procedure be taken for opening the chest, the splinters of bone should be removed, ragged ends of rib cut clean off, and all dead tissue excised.

Examination of the wound in this way may reveal either a bleeding intercostal artery or a large hole, hitherto unsuspected, leading into the chest, and a finger introduced into the pleural cavity may feel splinters of bone, free or sticking into the lung. Such splinters should be removed, for they play an important part in the production and maintenance of infection.

At this stage the case has been converted into one of open haemothorax. The surgeon has to decide whether to content himself with what has been done, or to open the chest widely and deal with the lung and pleural cavity. If it is decided not to open the chest, the blood should be evacuated as far as possible by rolling the patient on to his side, and then the chest should be closed in layers—pleura to pleura, muscle to muscle, and skin to skin.

It is absolutely essential that the chest should be closed, for otherwise infection will inevitably ensue. So if it is impossible to make the two surfaces of pleura meet, muscle should be brought over the gap, and if there is a deficiency of both pleura and muscle, the hole should be covered with skin even if a flap has to be cut.

In my experience it is seldom advisable to be content with excision merely of the parietal wound. If the patient's condition will stand the complete operation, the results are better.

Opening the Chest: Choice of Route.

If it is decided to open the chest and deal with the contents the surgeon has to decide whether to make the opening through the wound or to make a fresh incision. (Thoracotomy through the wound or by fresh incision.)

The deciding factor is whether he can attain his object—that is, removal of foreign bodies, cleansing and repair of lung and pleura—by enlarging the wound. This depends upon the position of the wound. If the wound is in a suitable position, four inches of the rib should be resected subperiosteally. With the use of a retractor or rib-spreader, this amount of resection allows insertion of the hand and free access to the pleural cavity. If the wound is not in a suitable position, thoracotomy by fresh incision should be performed.

Resection of four inches of the fifth or sixth rib in the anterior axillary line gives a good exposure of the thoracic contents, and if there are no other considerations this is probably the best and easiest route to follow. It has to be remembered, though, that if drainage of the pleural cavity has to be performed later on, it cannot be done effectively through this incision. Therefore, if the nature of the wound and missile is such as to indicate probable future infection, it may be advisable to choose a lower rib and make the incision more posteriorly.

Inspection of Thoracic Contents.

When the chest is widely opened the first thing the surgeon sees is a lot of blood in the pleural cavity. This has to be removed, for it obscures vision. The blood is removed by mopping, rolling on to the side, or scooping with the gloved hand.

Then the collapsed lung, the diaphragm, and the heart or mediastinum come into view.

The foreign body, if present, may be visible at once. If not, the hand may be inserted and the foreign body located. It is often found lying in the pleuro-diaphragmatic fold.

Treatment of the Wounded Lung.

The lung may be made to present out of the wound by the hand, aided by a pair of Duval's forceps. If a foreign body is lodged in the lung it should be located. It is easy as a rule, for it generally seems to be near the surface.

The wound in the lung should be treated now, if possible, as any other wound—that is to say, it should be excised and sutured. If the wound is near the surface of the lung this is easy—if necessary, a wedge of lung tissue may be excised and then closed by catgut sutures. If there is a long track through the middle of the lung, it is obvious that it is not practicable to slit this up along its whole length. In such a case it should be cleansed as well as possible by rubbing with gauze, either on a probe or by a pull-through.

In every case the hole in the lung should be closed. It is true that the mechanical cleansing may often be incomplete, but it is also clear that the lung tissue, owing to its vascularity, is able to contend with a certain degree of infection. As evidence of this one points to the extreme rarity of gas gangrene of lung tissue.

Though at first sight this appears to be a heroic operation, blood pressure records show that it is attended by a smaller fall of blood pressure than a similar one on the abdomen, associated with handling of the intestines.

Bleeding from the parenchyma of the lung is not to be feared, and the handling of the lung does not cause recrudescence of bleeding. I have only seen two cases of continued bleeding from the lung, and in each case this was due to inability of the lung to collapse.

Wound of Diaphragm.

The wide opening of the chest often reveals a wound of the diaphragm. This can be treated easily by excision and suture.

Cleansing of the Pleural Cavity.

In most cases it is only necessary to cleanse the pleural cavity by swabbing it dry and clean. If there has been much soiling it can be washed out. The French often swab it with ether. In any case the chest must be left dry.

Closure of the Chest.

Whether the operation has been performed through the wound or by fresh incision the chest must always be closed. The relief afforded the patient is instant and marked. In the majority of cases healing will be by primary union.

After-Treatment.

A successful case requires no special after-treatment. The patient is comfortable, breathes easily, the lung expands quickly, and convalescence is uninterrupted.

One point that has to be watched for is an accumulation of fluid in the pleural cavity, and systematic needling is advocated, as it is difficult to detect a small amount of fluid by physical examination.

It is to be remembered, though, that the more complete and careful the operation the less likelihood of any pleural effusion there will be.

ABDOMINO-THORACIC INJURIES.

Injuries involving both the chest and the abdomen are not infrequent, either as the result of a single or multiple missiles. When a missile has traversed both chest and abdomen the diaphragm must necessarily be injured, and abdominal viscera may herniate into the pleural cavity. This complication is more frequent on the left than on the right side because of the protection of the liver.

As efficient repair of the diaphragm can only be obtained from above, it is better in such cases to open the chest first, replace the abdominal contents, suture the diaphragm, deal with the chest as already indicated, and then, if there is evidence of injury to hollow viscera, laparotomy may be performed

The passage of a small missile through the diaphragm may not necessitate repair. In such cases where there is evidence of injury to hollow viscera, the abdomen is afforded preferential treatment.

Similarly, with multiple injuries involving both chest and abdomen, it is probably better to deal with the abdominal injury first, but when the patient's condition allows, the chest wound should be dealt with in addition, even if only to excise the parietal wound.

Simple Haemothorax.

Probably most people will agree that patients with large parietal wounds and retention of large missiles should receive some treatment as indicated above. If we pass now to a group of cases in which the main feature is a haemothorax, there will probably be differences of opinion.

Take a case of a man with a through-and-through bullet wound, the wounds of entrance and exit being small and clean, and the only damage apparent a haemothorax of mild degree—say, 20 oz. What is the correct treatment? If that man is left alone or is treated by aspiration he will probably recover. The haemothorax, though, may become infected after two or three days up to two or three weeks. If infection occurs, the man runs the risk of death or prolonged convalescence following empyema. If it were possible to foretell which case would become infected, there would be no doubt that the correct treatment would be early operation, with evacuation of the haemothorax, and closure of the chest. It is, however, impossible to foretell this.

I am undecided as to the correct treatment of such cases. A critical survey of the late results of unoperated cases would be most helpful.

Infected Haemothorax.

Incidence of infection will be diminished according to the attention paid to the complete excision of wounds of the chest wall. But infection of the intrapleural contents occurs also in cases of small clean wounds where no foreign body is retained, and also excision of the parietal wounds, and particularly in men who have lost a large quantity of blood.

The infecting organism and resulting toxaemias vary considerably; in my experience, while a mixed infection is always severe, the anaërobic bacilli are among the most benign, and the streptococci—especially if haemolytic—are the most dangerous. Evidence of infection is rarely seen before the third day after the wound, and may be delayed for many days. The only certain evidence of infection is either a positive bacteriological finding or the removal of stinking fluid. By clinical signs it is often possible to diagnose the presence of infection before organisms can be detected by the bacteriologist.

As soon as infection is proved or suspected the essential treatment is to empty the chest of all infected blood and clot. This cannot be done by aspiration and must be done by open operation. The common practice has been resection of one inch of rib and insertion of a tube. Provided that the operation is done within a few days of the receipt of the wound, it is better to do a wider resection, by which means all clot can be removed and the pleural cavity washed. The chest should then be closed. This method offers the following advantages:

1. The chest may remain closed, the organisms not developing.
2. The lung is allowed to expand and adhesions may form which will prevent complete collapse, even if the pleural cavity is subsequently drained.
3. Respiratory distress is much less with the closed chest.

The condition of the pleural contents can be determined by post-operative needling. If infection persists, the chest must be opened and drained; this can be done by the removal of sutures from the resection incision, provided only that the incision has been made in a suitable place—that is, low and postero-laterally.

I look upon the drainage of the chest as I do in amputation of a limb. It is sometimes necessary to save life but still a surgical failure.

Late Results.

I am unable to say much from my own experience of the end results of chest wounds, and the relative values of operative and non-operative interference, and the extent to which early operation should be pushed, neither can I furnish you with long lists of figures. This, however, I can say: During the period including the retreat of our armies in the spring of 1918 and their equally rapid advance during the summer and autumn, in which periods military exigencies prevented much surgery, then the results obtained were markedly worse.

Lessons Learnt in Military Service which may be Applied to Civilian Practice.

On this subject I speak very tentatively, though it is one deserving careful consideration. There are three points I would like to submit:

1. The treatment of crushed or "stove in" chests. These cases occur in civilian practice. When associated with severe laceration of the lung by indriven fragments of bone, thoracotomy may be of service.

2. Can we make use of thoracotomy for the cure of intrathoracic carcinoma of the oesophagus? Last autumn I had the advantage of a long conversation on this subject with Dr. Willy Meyer of New York. He has the best pressure chamber installation I have seen. Dr. Meyer is not very hopeful on this question, and he issues a very urgent warning, believing that the condition of patients wasted with malignant disease of the oesophagus renders them much more dangerous subjects for thoracotomy than the vigorous soldiers on whom we operated in France. Dr. Meyer's warning deserves careful consideration.

3. Can we improve the treatment of empyema? On this point I am more hopeful. I suggest that in certain cases, particularly of children with a pneumococcal empyema, the pleural cavity may be washed out and the chest closed without the use of a drainage tube. This method has been performed successfully, and my belief is that in suitable picked cases it may prove beneficial.

SECTION OF PREVENTIVE MEDICINE AND PATHOLOGY.

THE DYSENTERIES: BACILLARY AND AMOEBIC.

OPENING PAPERS.

I.—LEONARD S. DUDGEON, C.M.G., F.R.C.P.,
Colonel A.M.S.

BACILLARY.*

IT is only possible to refer very briefly to a few of the most important data which concern the bacteriology of bacillary dysentery owing to the very limited time which has been allotted to "openers of discussions" by your Council.

Bacillary dysentery is an infectious disease due to specific organisms, characterized by fever, tenesmus, diarrhoea, followed by passage of blood and mucus. These clinical phenomena are present in typical cases of the disease, but it is essential to realize that dysentery bacilli may be isolated from patients who have had diarrhoea for a period of twenty-four hours without any other clinical manifestations. Such cases readily respond to "household remedies," and unless bacteriological investigations are undertaken at the outset the chances of recovering dysentery bacilli are remote.

In countries in which bacillary dysentery is epidemic and endemic such cases are of considerable importance from the epidemiological standpoint. Further, it is the mild cases of diarrhoea due to dysentery bacilli which serve to explain the abnormal serological findings not infrequently referred to in the literature. A negative

* The investigations referred to in this communication were made by me and my co-workers, Major A. L. Urquhart, O.B.E., R.A.M.C., Captain W. R. Logan, M.D., R.A.M.C., Captain J. F. Taylor, M.D., R.A.M.C., Captain J. Bamforth, M.D., R.A.M.C., Captain B. J. Ryrie, R.A.M.C., Captain A. Wilkin, R.A.M.C., while special assistance was given by Captain J. F. Gaskell, F.R.C.P., R.A.M.C., and Captain R. R. Elworthy, O.B.E., R.A.M.C.

history of a bacillary dysentery infection among those who served on Gallipoli, in Macedonia, or in Egypt, is of little value, but the number of troops returned to this country from the Eastern Mediterranean, and who are yet to come, is a matter of considerable importance to the public health departments, and to medical practitioners of Great Britain, Australia, Canada, and New Zealand.

The bacilli which are now known to give rise to dysentery are (1) the Shiga bacillus, (2) para-Shiga bacilli, (3) Flexner group, and those bacilli which may be grouped provisionally as para-Flexner bacilli.

Haemocultures in Cases of Bacillary Dysentery.

These were made in 145 cases during the acute stages of the infection; 2 to 5 c.cm. of blood were added to 20 to 30 c.cm. of either 2 per cent. bile salt in distilled water, or 1 per cent. glucose citrate broth and broth with the addition of trypsin. In two cases of acute dysentery the Flexner bacillus was recovered from the blood stream. In all other instances the blood was found to be sterile by the methods adopted, and in spite of the fact that the majority of the cases were examples of acute Shiga dysentery.

The Bacteriological Investigations of Acute and Chronic Bacillary Dysentery.

It is a notorious fact, well known to bacteriologists who have studied this disease in subtropical and tropical countries, that a high percentage of positive findings can be obtained only if the samples of stools are received in the laboratories in the fresh state. If the specimens consist of pure blood and mucus, an interval of a few hours is permissible between the time the sample is collected from the patient and the bacteriological examination, but if faeces are present with blood and mucus it is essential to avoid delay.

There is frequently a considerable distance between the medical unit in the front area at which the dysenteric patient is first seen and the mobile laboratory which supplies this area, so that a delay of many hours may elapse between the collection of the specimens and their arrival in the laboratory. It is therefore obvious that any device which can be adopted to counteract the changes that occur in blood and mucus stools mixed with faeces, or in diarrhoeic stools which cannot be bacteriologically examined for many hours, is the best working solution of the problem. In general hospitals on active service such requirements are only necessary when samples are collected during the night.

Dr. Lucius Nicholls published a paper in the *Lancet* on the chemical affinities of *Vibrio cholerae*. In this communication he directed attention to the susceptibility of this organism to the action of acids.

We have applied a similar line of investigation for dysentery bacilli which has led to the following conclusions: That dysentery bacilli are sensitive to the presence of free acids, while they are able to grow freely in alkaline media. Further, suppressed vitality induced by acids may be recovered from by the addition of an alkali. These experiments suggested the possibility offered by the addition of alkali to blood and mucus stools containing faeces, and diarrhoeic stools in which the presence of a member of the dysentery group was suspected. Blood and mucus stools are alkaline when freshly passed, but if faeces are present and the sample is allowed to remain at laboratory temperature for some hours an acid reaction may develop. Experimental evidence was obtained that the addition of an equal volume of 3 per cent. normal sodium hydrate to pure blood and mucus stools at the time the specimens were collected from the patients was a distinct advantage, and still more so if the dysenteric stools contained faecal matter. A higher percentage of positive findings occurred when it had been necessary to delay the bacteriological examination for some hours.

The Shiga Bacillus and para-Shiga Bacilli.

The strains of the true Shiga bacillus isolated from cases of dysentery during the seasonal periods of 1916, 1917, and 1918 have not shown any characteristics which call for special comment either in cultural or serological reactions, apart from the few strains which have fermented maltose. This sugar was also fermented by four out of a total of forty-one strains of para-Shiga bacilli submitted to complete investigation. Our experience of bacillary dysentery in the Eastern Mediterranean from 1915 to the end of 1918 has confirmed the previous experience of other investigators that the most severe cases are usually due to the bacillus of Shiga.

Schmitz in 1916, during an epidemic of dysentery, isolated an organism which he regarded as a specific bacillus capable of exciting dysentery in the human subject. Captain Cecil Clarke, R.A.M.C., sent to the Central Laboratory, Salonica, in February, 1917, a culture of an inagglutinable strain of Shiga bacillus which he had isolated from a case of dysentery. A rabbit was immunized with this organism, and a supply of the serum was distributed among the laboratories in the command. Since that date numerous strains of this organism have been isolated from cases of acute dysentery in Macedonia and from patients suffering from diarrhoea with or without mucus. Further investigations have shown that there are two groups of these bacteria which can be differentiated by serological tests, and by the fact that the group which we have designated para-Shiga + produces indol, while the para-Shiga fails to do so. Our para-Shiga + bacillus corresponds to the organism isolated by Schmitz. We have investigated fully at the Central Laboratory forty-one strains of the para-Shiga bacilli, of which thirty produced indol. By means of antiserums supplied to the various laboratories in the command these bacilli have been labelled as readily as the true Shiga bacillus.

Complete agglutination and absorption tests made by us have shown that agglutinins formed by the para-Shiga bacilli are specific, and similarly those produced by the indol-forming bacillus, while the true Shiga bacillus is not agglutinated by the para-serums or the para-bacilli by anti-Shiga serums. Absorption of agglutinins does not occur under these conditions. We found that rabbits were immunized with much greater difficulty with the para-Shiga bacilli than with the true Shiga bacillus, although the para-Shiga organisms were "on the whole" much less toxic than the strains of Shiga bacilli which we have investigated. In the Balkans both types of para-Shiga bacilli have been recovered from blood and mucus stools. Captain E. G. D. Murray, R.A.M.C., in his valuable contribution to the subject of bacillary dysentery, states that in his opinion *B. dysenteriae* "Schmitz" is a clearly defined species of dysentery organism.*

The Flexner Group.

Cultural tests are always necessary in the preliminary examination of the Flexner group, so as to eliminate organisms which do not belong to the dysentery groups, and to give an indication as to which agglutinating serum or serums should be employed. The cultural characteristics may be regarded as (1) primary and (2) secondary. The primary include the action on gelatin, lactose, glucose, and mannite, while the secondary reactions are on cane-sugar, maltose, dulcitol, litmus milk, indol formation, and the presence or absence of haemolytic activity. The Flexner bacilli conform to the primary characteristics, but the secondary reactions are so inconstant and unstable as to nullify their use for the classification of these organisms. Further, bacilli which are similar as regards their serological reactions may have entirely different secondary characteristics; 140 strains of Flexner bacilli were examined by us, and it was found that the primary characteristics of this group were constant, but the secondary were not even constant in the same strain subcultured over a period of months. We agree with the findings of C. J. Martin and Williams that variations in fermentation of maltose and cane sugar occur, and that indol formation is not a constant phenomenon, while we also regard the fermentation of dulcitol as inconstant. Our results have indicated that bacilli which when first isolated belong to the so-called "Y" group are especially liable to alter their cultural characteristics. On the other hand, our classification of Flexner strains into various groups as a result of agglutination and absorption tests is entirely artificial. There is no justification for the rejection, as a cause of dysentery, of bacilli which retain the primary cultural characteristics of the Flexner group for five days if they do not agglutinate with the available antiserums. It is possible that a complete investigation of aberrant strains may prove of value in the grouping of the

* The toxicity of Shiga strains is considerably reduced in formalin-killed cultures.

mannite fermenters.* If several anti-Flexner serums are employed as a routine procedure for the investigation of the mannite fermenters serological reactions may be obtained with various strains which otherwise would be termed inagglutinable. This method, to which C. J. Martin and Williams drew attention, is now being widely adopted in all dysentery laboratories.

Morgan's Bacillus No. 1.

In certain periods of the dysentery seasons this organism has occurred with much greater frequency than at other times. During such times it has been isolated from blood and mucus cases, but no apparent reason has been forthcoming for the rise in the Morgan incidence. In no case has any Morgan agglutinin been formed in the serums of these patients. Considerable work has been done with the idea of obtaining a multivalent anti-Morgan serum, but without success, as all such antiserums are strictly autogenous in their action.

The Examination of Shiga, para-Shiga, and Flexner Bacilli by the Acid Agglutination Test.

Michaelis recommended this test, which, in his opinion, could be readily applied for the identification of dysentery bacilli, even in laboratories with the meanest equipment. It consists of the addition of normal sodium hydrate and normal acetic acid, in definite and varying quantities, to emulsions of bacilli. Michaelis considers that dysentery bacilli never show agglutination by this method, either with or without the addition of traces of blood serum, and therefore can be readily recognized by this method, while atypical bacilli can be distinguished from true dysentery bacilli. This method has been studied fully by us, but in our opinion it has no practical utility. In those instances in which it was necessary to employ elaborate serological tests to identify a bacillus isolated from a case of dysentery no help was ever obtained by the application of the ready method of Michaelis. True Shiga and Flexner bacilli may react normally or abnormally, while comparative experiments with strains recently isolated and then stored on laboratory media have shown wide differences. Murray, in the paper already referred to, makes the following statement, with which we are in complete agreement, "that Michaelis's acid agglutination reaction is of no value in determining whether or not a given bacillus belongs to the dysentery group."

Agglutination Reactions in Cases of Bacillary Dysentery.

The antigens for these reactions were prepared as follows: Roux flasks of agar were inoculated with twenty-four hours cultures of bacilli which had previously been subcultured for ten days in succession. The flasks were incubated for twenty-four hours at 37° C., then the growths were washed off with saline containing 0.1 per cent. formalin, filtered through glass wool and stored, as recommended by Dreyer, in the ice safe until sterile. The antigens were standardized to contain 1,500 million bacilli per c.cm. The reactions were carried out at 55° C. for five hours, and then the end points read after half an hour at room temperature. Auto-agglutination did not occur by this method and lysis was not observed, but individual strains of Flexner bacilli were found to vary considerably in their agglutinability.

Each antigen as it was prepared was tested to end point with antiserums reserved for this purpose, and again a few weeks later. With these antigens the following conclusions were arrived at from the study of the blood serum obtained from a considerable number of cases of bacillary dysentery:

1. A reaction of 1 in 40 is a positive indication of a Shiga infection.
2. A reaction of 1 in 25 is strongly suggestive, and the test should be repeated about a week later.
3. Shiga cases may show a high Flexner reaction.
4. Cases of para-Shiga dysentery do not give a Shiga reaction.
5. Many cases of so-called clinical dysentery can be proved to be Shiga infections by this method.
6. A rising or falling Shiga reaction is of considerable importance in the diagnosis of a Shiga infection.
7. In every case of dysentery accompanied by pyrexia of unexplained origin, a Shiga agglutination reaction should be undertaken, as it has been found to be of considerable importance in the diaguosis of such cases.
8. Absorption tests are of value in the diagnosis of Shiga infections.
9. It is necessary to employ at least two, but preferably more, Flexner antigens for the investigation of Flexner cases.
10. We do not feel justified, from the type of material at our disposal, in dogmatizing as to what is diagnostic of a Flexner infection, and also because Flexner antigens vary considerably in their susceptibility to human serums. We recommend that a reaction of 1 in 150 should be taken as an approximate standard with an antigen of 6,000 end point, but the reaction should be repeated a week later, and the presence of Shiga agglutinins should be excluded.

Arthritis as a Complication of Bacillary Dysentery.

Twenty-five cases of arthritis occurring in one or more of the large joints have been met with, and in the majority of instances the diagnosis of anti-serum arthritis could be excluded. Conjunctivitis was associated with the arthritis in some instances, but as this complication is readily overlooked it is impossible to state how often it occurs. In ten cases the joint fluid was fully investigated, and in seven of these cases the Shiga bacillus had been proved to be the cause of the intestinal infection. Captain R. R. Elworthy, R.A.M.C., cultivated the Shiga bacillus from the joint fluid in one case, but in all other instances it was found to be sterile, although the exudates were turbid and pus cells were abundant. Two cases were proved to be Shiga infections by the agglutinin content of the exudate (1 in 150 and 1 in 100), and in one instance a reaction of 1 in 300 was obtained with one of the Flexner antigens. All experiments with these exudates when inoculated into rabbits proved of no assistance in providing the necessary proof of the nature of the infection. Some cases of arthritis associated with Shiga dysentery improved rapidly under vaccine treatment.

Three methods by which bacillary dysentery is believed to be spread among a healthy population may be briefly referred to.

Carriers.

The occurrence of mucus in the stools should be regarded always with grave suspicion among patients with a previous history of dysentery. Dr. E. H. Lepper, in her report to the D.M.S., B.S.F., made the following statements:

> It is hardly possible to over-estimate the importance of mucus in the stools as a sign of continued infectivity, for as a rule in any particular case the positive results are only obtained from the mucoid specimens, the normal stools that are passed are negative.

Dr. Lepper therefore recommends that it should be the duty of medical officers in dysentery hospitals to select samples of faeces which contain mucus for bacteriological examination, and to notice if patients who are to be discharged from hospitals are passing shreds of mucus. Dr. Lepper's results showed that the percentage of convalescent dysentery patients who are carrying bacilli is about 6, but three months after the onset this has been reduced to 1.5 per cent. In addition to the presence of mucus in the stools, which is of so much importance in the diagnosis of carriers, we have found that some patients who have apparently recovered from dysentery and were not passing mucus at the time when it was searched for, showed a positive Shiga agglutination reaction.

The Vitality of the Shiga Bacillus in Sterilized and Crude River and Aqueduct Water.

The opportunities for infecting stored or well water on Gallipoli and in certain other Eastern areas were probably as great as could occur outside a laboratory experiment. It is known only too well the important part dysentery has played in these areas. It was largely for this reason that these experiments were conducted, and, very briefly, the following results were obtained: The Shiga bacillus was cultivated up to a period of ninety-six hours from crude water which had been stored at 37° C., while from sterilized water it was possible to isolate the

* Early, transient, and slight fermentation of lactose occasionally occurs with true dysentery bacilli. No importance has been attached by us to the fermentation of lactose at the end of three weeks, while we have had no experience of true lactose fermenters as a cause of bacillary dysentery.

Shiga bacillus at 240 and 336 hours when it was stored at room temperature, but not if storage was permitted at 37° C. Experiments showed that it was possible to cultivate the Shiga bacillus from river water stored at room temperature for 576 hours, but this was found to be impossible with water stored at 37° C. Further, the bacillus retains its cultural and serological reactions when stored in water. The Shiga bacillus was cultivated from water which had been chlorinated previously by an expert.* These experiments show the necessity for efficiently protecting all water which is to be employed for drinking purposes.

The Fly as a Carrier of Bacillary Dysentery.

These experiments, which can be referred to only very briefly, were conducted by Captain J. F. Taylor, R.A.M.C. Two years' experience of bacillary dysentery in Macedonia showed that while bacillary dysentery occurred to some extent among the troops throughout the warmer months, there were two periods of the year when it assumed a greater prevalence, namely, spring to early summer and from the late summer to early autumn, at the periods when the fly pest was at its worst. During the hottest months of summer flies were considerably reduced in numbers, and there was comparatively little dysentery. The incidence of flies was estimated by observations made in the camps of two hospitals situated on the seacoast. Two fly-traps were placed in fixed spots in each of the two hospitals every day from 11 a.m. to 2 p.m. The flies were counted in each trap after the three hours' exposure, and at the end of each ten days the average number of flies per trap per day was calculated. It was found that the first fly pestilence in April and May was immediately followed by a great increase in dysentery in May and June, while the second, in September, October, and early November, was accompanied by an increase of dysentery of equal severity. The incidence of dysentery was calculated on the number of cases which had occurred among the patients in the two hospitals.

Certain experiments were conducted for the purpose of ascertaining whether flies fed on material known to contain Shiga and Flexner bacilli would show positive findings at varying intervals. The examination of the flies was made by (1) the walking or natural method, (2) the faeces, and (3) the legs, with the following results: The prospect of recovering the infecting organism from the fly diminishes very markedly at and after twenty-four hours from the time of infection; that the examination of flies' faeces is the most suitable method for the isolation of dysentery bacilli.

The Examination of the Wild Fly.

The flies for examination were caught in various parts of the two hospitals—wards, kitchens, latrines—but there were no wards in either hospital allotted to cases of dysentery. The results of these investigations were as follows: A typical Shiga bacillus was isolated on one occasion from a fly captured in a hospital kitchen out of a total of 1,670 flies examined. A para-Shiga bacillus was obtained on one occasion, and inagglutinable strains of Flexner bacilli on eight occasions. In another series not included in the above a Flexner bacillus was also isolated from a fly captured in a hospital kitchen.

CONCLUSIONS.

(1) Bacillary dysentery is most prevalent when flies are most numerous. (2) Flies after contact with food infected with dysentery bacilli are capable of carrying and disseminating these bacilli for at least twenty-four hours. (3) Dysentery bacilli were isolated from wild flies captured in places in which bacillary dysentery is both endemic and epidemic.

In our opinion the following points require much more elaborate investigation: (*a*) The vitality of dysentery bacilli in water. (*b*) The relationship of flies to bacillary dysentery. (*c*) Further investigations with the Flexner group of dysentery bacilli and with inagglutinable strains of Flexner bacilli. (*d*) On the toxins produced by dysentery bacilli. (*e*) The preparation of more suitable antiserums for the treatment of the disease.

* Each sample of water employed in these experiments (500 c.cm.) was inoculated with one loop of a twenty-four hours' culture of Shiga's bacillus in Dreyer's medium.

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AMOEBIC DYSENTERY IN ENGLAND.

WHEN the secretary invited me to open the discussion on amoebic dysentery he suggested that special reference should be made to diagnosis, the importance of carriers, and the chances of the disease becoming endemic in this country. I propose to limit my remarks entirely to these aspects of the subject.

During the last three years the Liverpool School of Tropical Medicine has undertaken the diagnosis and treatment of very large numbers of cases of dysentery amongst soldiers in the local military hospitals. In order to cope with the vast amount of laboratory work which this entailed the services of Messrs. J. R. Matthews and A. Malins Smith were employed by the school. These gentlemen have been with us during the whole of the three years, and it is to their records that I am indebted for the bulk of the data quoted below. We have also to acknowledge the assistance of Miss D. Mackinnon and Mr. H. F. Carter, who took part in this work during the year 1916–1917.

Much time and labour have been devoted in different parts of the country to the detection of carriers of *Entamoeba histolytica* among soldiers invalided to this country from the various theatres of war. This routine procedure was undertaken for two main reasons:

1. Carriers of *E. histolytica* cysts were regarded as dangerous to the community, in that they might be a means of infecting others.
2. So long as a man harboured these cysts it was considered that he might be subject to a relapse of acute dysentery or to hepatic abscess.

In all, over 4,000 chronic or convalescent dysenterics have been examined at the Tropical School in Liverpool, and *E. histolytica* cysts have been found in about 11.5 per cent. of cases.

In view of the fact that Dobell (1916) had found that 11.8 per cent. of 110 New Zealanders, who had been invalided to this country from Gallipoli and Egypt for diseases other than dysentery, were infected with *E. histolytica*, and of somewhat similar results obtained by Wenyon and O'Connor in Egypt about the same time, it was decided to examine non-dysenteric soldiers in the Liverpool Tropical Hospital. Of 450 such cases examined, about twice each, 7.8 per cent. were found to be infected. The discovery was very striking, and led naturally to the question whether the infection exists among soldiers and civilians who have never been out of England and Wales.

E. histolytica Indigenous in England.

The results of one examination of a considerable number of persons who have never been abroad are given in Table I, as are also, for purposes of comparison, those of convalescent dysenteric and non-dysenteric soldiers invalided from abroad.

From Table I it is clear that there is a considerable percentage of individuals infected with *E. histolytica* amongst persons who have never been out of Great Britain. It might be stated at once that with very few exceptions all these persons were apparently healthy, none gave a history of dysentery, and in only one were the vegetative stages of an entamoeba found. On examining the table more carefully, it will be seen that the degree of infection amongst different groups of the population varies considerably—for example, among 548 children (in a children's infirmary) 1.8 per cent. were found to be infected with *E. histolytica;* among 450 men and women (patients in a general hospital) 1.5 per cent.; among 1,098 young recruits 5.6 per cent., and among 207 lunatics 9.7 per cent.

Considering the manners and customs of the inmates of an asylum, it is perhaps not surprising that the degree of infection amongst them should be so much greater than amongst the general population in an ordinary civilian hospital. It is, however, not so easy to assign a reason for the relatively large percentage of infections found

TABLE I.—*Summary of the Results of Protozoological Examinations of Faeces made at the Liverpool School of Tropical Medicine during the Last Three Years.*

Class of Case Examined.	Date of Examination.	Number of Cases Examined.	Percentage found infected with		
			E. histolytica.	E. coli.	G. intestinalis.
1. Convalescent dysenterics in military hospitals...	May, 1916 to Dec., 1918	4,068	1st exam. ... 7.0 About 3 exams. each 12.1	1st exam. ... 15.2 About 3 exams. each 29.7	1st exam. ... 9.9 About 3 exams. each 16.4
2. Patients in military hospitals for diseases other than dysentery	June, 1916, to June, 1917	450	1st exam. ... 6.4 About 2 exams. each 7.8	1st exam. ... 14.2 About 2 exams. each 21.1	1st exam. ... 6.0 About 2 exams. each 9.5
3. Persons who have never been abroad. (The results are based on one examination per case.)					
A. Civilians in Liverpool Royal Infirmary ...	1917	450	1.5	6.7	6.0
B. Children under 12 years old in Liverpool Children's Infirmary	Feb. to Nov., 1918	548	1.8	11.1	14.1
C. Recruits 18-19 years old in training camp:					
Batch. *Average sojourn in camp before exam.*					
i. ... ... 2-3 months ...	April, 1917	263	3.0	12.1	4.5
ii. ... ... 2-3 months ...	Aug., 1917	241	6.6	23.2	7.5
iii. ... ... 5 months ...	Oct., 1917	230	3.9	14.8	6.1
iv. ... ... 1 month ...	April, 1918	98	6.1	21.4	8.2
v. ... ... 2.5 days	May, 1918	81	8.2	22.4	11.8
vi. ... ... 9 days	May, 1918	105	6.6	17.1	6.6
vii. ... ... 16 days	June, 1918	78	12.8	23.1	10.2
Total recruits ...	... ...	1,098	5.6	18.2	7.0
*D. Lunatics in an asylum	June, 1918, to Feb., 1919	207	9.7	45.9	3.4
4. Soldiers returned from abroad stationed at camp in which were recruits mentioned above	Oct., 1917	90	7.8	23.3	5.6

So as not to overburden the table, infections with *E. nana*, *Tetramitus*, and *Trichomonas* are omitted. The figures are, except where otherwise stated, the results of a single examination only in each case, and are therefore comparable.

amongst the young recruits. The, at first sight natural, explanation that the recruits had contracted the infection in the training camp from men who had returned from abroad received support from the fact that 7.8 per cent. of 90 of the latter were found to be infected. It was, however, soon found necessary to abandon this hypothesis, as further investigations showed heavy infections amongst recruits who had been in camp for an average of only 2.5 days. It is clear, then, that the recruits had taken the infection to camp with them, and had not contracted it there. One is forced, therefore, to the conclusion that for some reason young men of 18 to 19 are more heavily infected than the civilian population regarded as a whole. The explanation of this is still obscure, but evidence is available which suggests that possibly occupation, or mode of life, may have something to do with it. Referring again to Table I, it is interesting to note that the percentage of infections found varied considerably in different batches of the recruits—for example, in Batch vii the percentage found to be infected is much greater than in any of the other batches. Although the comparatively small size (78 men) of this batch precludes the possibility of drawing definite conclusions, it is perhaps worth recording that all the men were South Wales miners. Further insight into the method of spread of the infection is obtained from most interesting observations made by Matthews and Smith (1919). They singled out six of the children found by them to be infected with *E. histolytica*, and then proceeded in each case to examine, so far as was possible, the whole family of which the infected child was a member. In the first family *E. histolytica* was found in the stools in seven of eight members, in the second in four of four, in the third in two of four, in the fourth in one of three, in the fifth in two of three, and in the sixth in one of three. Thus, in the six families, comprising twenty-five members, no less than seventeen (68 per cent.) were found infected with *E. histolytica*.

These two observations—the prevalence of the infections amongst the miners and the extraordinarily high proportion of infections amongst the members of the six families mentioned—are most important, and indicate in a striking manner how under certain conditions infection can spread in this country.

Now, in the past, in fact even up to the present time, it has been generally accepted that the infection which has been discovered amongst our troops invalided home from the East for causes other than dysentery has been acquired abroad in places where amoebic dysentery is endemic—for example, the Eastern Mediterranean, Egypt, India, Mesopotamia, and Africa. This is a very important question from the point of view of the public health of this country, and it will be interesting to examine the hypothesis in the light of the information recorded above.

Wenyon and O'Connor (1917) in their admirable book entitled *Human Intestinal Protozoa in the Near East*, record the result of examinations of healthy British troops in Alexandria, and of healthy natives in an Alexandrian prison; a single examination of each individual showed that 5.3 per cent. of the former were infected with *E. histolytica*, and 13.7 per cent. of the latter. From these facts Wenyon and O'Connor conclude that the native of Egypt is acting as a reservoir of infection for the intestinal protozoa with which the British troops have become and are becoming infected. This was, of course, a natural and legitimate conclusion from the evidence available to Wenyon and O'Connor at the time. It is, however, not without interest to examine it in the light of present knowledge.

All the results recorded in Table II are based on a single examination in each case, and are therefore comparable. The young recruits alone are included in this table because it is obvious that they represent the class of the civilian population which is most comparable with the soldier.

TABLE II.—*Showing Percentage of Cases infected with Intestinal Protozoa.*

	Number Examined.	E. histolytica.	E. coli.	E. nana.	G. intestinalis.	C. mesnili.
Recruits never out of Great Britain (Table I above)	1098	5.6	18.2	5.5	7.0	2 cases
Dysenteric convalescents (Mackinnon)	914	4.9	—	—	—	—
Non-dysenteric convalescents (Mackinnon)	766	3.5	—	—	—	—
Dysenteric convalescents (Liverpool)	1713	5.9	15.5	—	11.3	—
Non-dysenteric convalescents (Liverpool)	450	6.4	14.2	—	10.8	—
Healthy troops in Alexandria (Wenyon and O'Connor)	1979	5.3	20.0	0.5	4.8	1.1
Healthy natives in Hadra Prison, Alexandria (Wenyon and O'Connor)	524	13.7	48.6	0.0	0.57	0.19

The important fact stands out in Table II that the degree of infection with *E. histolytica* is approximately the same in the four groups:

(1) Young recruits who have never been out of England and who have been in the army only a short time.

(2) Non-dysenteric soldiers invalided from abroad.

(3) Chronic or convalescent dysenteric soldiers invalided from abroad.

(4) Healthy British troops in Alexandria.

If, now, the 1,098 recruits examined at Liverpool constitute a fair sample of the men who enlisted in the British army it is possible that the bulk of the infection found by Wenyon and O'Connor amongst the healthy troops at Alexandria was not contracted from the native population, but was taken out to Egypt from this country. On the other hand, it is possible that the infection is only of recent introduction into this country, and that the troops which originally went out to the East were not infected, but contracted the infection there from the native population, and on returning home they, in turn, infected the population of this country. I shall return to this question later.

Danger of Amoebic Dysentery Spreading in England.

Whether there is any danger of a serious outbreak of amoebic dysentery in this country is an important question which necessarily engages the attention of those responsible for the public health. Wenyon and O'Connor, writing on this subject, state "we may expect some temporary increase in the local cases of amoebic dysentery, but the disease is unlikely to gain a permanent footing in this country, for the British carrier will never in the long run aid the spread of the disease as does the insanitary native of Egypt." Unfortunately, however, in view of the widespread infection of intestinal protozoa found by Matthews and Smith in persons who have never been out of England, it appears that Wenyon and O'Connor were rather optimistic in their judgement of the sanitary conditions obtaining, at least amongst certain classes of the community, in this country.

In attempting to form an estimate of the danger of an outbreak of amoebic dysentery in England it seems to me a matter of considerable importance to determine whether the infection is of recent introduction into this country or is of old standing. Failing definite knowledge of the state of the population before the war as regards infection with *E. histolytica* it was necessary to be cautious in expressing an opinion, but the following considerations point, I think, to the conclusion that the infection, although only recently discovered in persons who have never been out of this country, is probably of old standing and not of recent importation.

1. "Carriers" must constantly have been entering this country before the war. Private individuals, traders, civil servants, etc., were returning from the tropics in numbers every day; from time to time large bodies of troops were brought back from countries where the disease is endemic; and, finally, countless sailors had landed in our ports from all over the world. Reference might here with advantage be made to the fact that of 82 non-dysenteric sailors examined by Matthews and Smith, 6.1 per cent. were found to be infected with *E. histolytica*, and also to the recent work of Baylis, who examined 400 men who had just entered the Royal Naval Service, and found ten (2.5 per cent.), eight of whom had never been abroad, infected with *E. histolytica*. Baylis also examined 888 cases in the Royal Naval Hospital, Haslar, most of whom were convalescent dysenterics, or were suffering from intestinal disorders of various kinds, and had been serving abroad, many of them in the Mediterranean area; cysts of *E. histolytica* were found in 52 (5.9 per cent.) of these. As Baylis himself remarked, these findings are the result of a single examination only of each case, and are therefore comparable with the Liverpool figures already quoted.

2. All the factors necessary for the spread of the infection are to be found in this country. The observations that amongst the asylum cases the proportion of infected was very high (9.5 per cent.); that amongst the 1,098 young recruits who had never been abroad the percentage of infected was equal to that in chronic or convalescent dysenterics, or in non-dysenteric soldiers invalided home for diseases other than dysentery; and that amongst the members of the six families examined by Matthews and Smith an astonishingly large proportion (68 per cent.) were infected—all lead one to the conclusion that under certain circumstances the infection can spread in England with the same facility as it does in regions where amoebic dysentery is endemic.

3. Notwithstanding the fact that before the war few but those directly engaged in the study of tropical medicine were familiar with the microscopic diagnosis of amoebic dysentery, there are on record in the literature details of well authenticated cases of acute amoebic dysentery and amoebic abscess of the liver. Reference to three such cases are given by Worster-Drought and Rosewarne, and details of three others by Laidlaw in a recent paper.

For these reasons I am inclined to believe that the widespread infection which the work of Matthews and Smith has disclosed amongst the population of this country is not of recent importation but is of old standing, and has not been discovered before simply because it was not expected, and therefore not looked for.

Whether the infection is of recent introduction or not, we are faced with the interesting state of affairs that certain classes at least of the population are heavily infected, but that very few indigenous cases of acute amoebic dysentery have so far been recorded. The facts (1) that under certain conditions the infection can spread in this country to such an extent that the population becomes infected to a degree equal to that found by Wenyon and O'Connor occurring in troops in Alexandria, and (2) that practically no cases of acute amoebic dysentery have yet been recorded, suggest that some additional factor, at present unknown, is necessary before acute amoebic dysentery develops. We have to recognize that even under the most favourable circumstances many are infected with *E. histolytica*, but comparatively few develop acute amoebic dysentery. It is interesting here to recall Walker and Sellards's classical experiments. These authors fed twenty volunteers (natives of the Philippines) on infected material from a case of chronic dysentery; of these, eighteen (90 per cent.) became parasitized, but only four (20 per cent.) developed amoebic dysentery, the incubation period varying from twenty to ninety-five days.

Diagnosis of Acute Amoebic Dysentery.

That there may be in this country many cases of amoebic dysentery, the true nature of which is not recognized, is, however, a possibility which I think cannot be dismissed without careful investigation. It seems to me that during the past two or three years attention has been focussed so intently on the "carrier" problem that one is perhaps in some danger of overlooking the claim of the actual dysenteric. From the administrative point of view the recognition of the "carrier" is a much simpler matter than the diagnosis and adequate treatment of the acute, or, more especially, the subacute dysenteric. The viability of the cysts outside the body is considerable, and they can readily be recognized in stools passed many hours or even days previously. In its vegetative stage the entamoeba is,

however, of low viability outside the body and the parasites quickly become unrecognizable, or recognizable only with the greatest difficulty by the expert. The present military system may be adapted for the recognition of "carriers," but it is by no means so well fitted for the diagnosis of acute or of subacute amoebic dysentery.

The recent Army Council Instruction (No. 78, of February 1st, 1919) on the treatment and disposal of convalescents from dysentery lays down amongst other things:

(*a*) The hospitals selected as dysentery hospitals should have on their staffs a competent bacteriologist and protozoologist, and the laboratory in which the diagnostic work is done should either be in the hospital itself, or in very close proximity to it.

(*b*) The dysentery cases should be in the charge of medical officers specially selected for their experience of, or aptitude for, the work, and as few changes as possible should be made in these appointments.

(*c*) The bacteriologist and protozoologist should be in intimate touch with the medical officer in charge of the cases, and should have full access to the patients and to their records.

With these admirable instructions I most cordially agree; experience in Liverpool, however, compels me to remark that it might be to the public advantage if those responsible for the instructions took steps to ascertain the manner in which their instructions are carried out.

On February 25th a patient was admitted to the Tropical School Hospital, Liverpool, suffering from acute dysentery. He was extremely ill, very emaciated, and passing daily fifteen to twenty stools consisting of little more than blood and mucus. On microscopical examination of the stools vegetative *E. histolytica* were found in large numbers; the case was obviously one of acute amoebic dysentery. The following significant history was obtained, partly from the patient's statements and partly from his records. On contracting dysentery in Mesopotamia in 1916 the man was sent to India, where he remained for two years, suffering from repeated attacks of acute dysentery. Towards the end of last year he was invalided home, and in December was admitted to one of the military hospitals in Liverpool. Specimens of the stools were sent four times to the Tropical School laboratory (a distance of about two miles from the hospital), and on each occasion the protozoological report was negative. As at the end of three months, during which no diagnosis was made, the patient's condition was desperate, he was transferred to the Tropical Hospital. This hospital is practically adjacent to the laboratory, and, as I have mentioned, a diagnosis of amoebic dysentery was made immediately on the patient's admission by the very protozoologist who had returned four negative reports on the material sent from the previous hospital. The explanation is obvious: the specimens sent from the first hospital were old and unsuitable (a little bloody mucus mostly absorbed in a cotton-wool plug).

The history of such a case illustrates the desirability, from the patient's point of view, of a rigid application of the Army Council Instruction quoted above. If the organization designed for the diagnosis of dysentery is defective in the case of acute dysenterics who are still in the army it is not difficult to imagine what it must be in the case of pensioners and others invalided from the army for chronic dysentery and who are scattered all over the country. How many of such cases in the event of a relapse of acute dysentery are likely to have the benefit of the opinion of a skilled protozoologist?

Can E. histolytica be Distinguished from E. coli?

Before leaving the subject of acute dysentery I might refer very briefly to the difficulty of distinguishing the vegetative stage of *E. histolytica* from the corresponding stage of *E. coli*.

While there is little difficulty in distinguishing the encysted stage of *E. histolytica* from the corresponding stage of *E. coli* most workers will agree that the differentiation of the vegetative stages of the two entamoebae is a matter of the greatest difficulty. Wenyon and O'Connor, recognizing the practical difficulties standing in the way of accurate diagnosis, decided to call no infection one of *E. histolytica* unless at least some of the amoebae contained red blood corpuscles, or unless they could find definite cysts of *E. histolytica* associated with the amoebae in the stool. In order to determine whether *E. coli* ingest red blood corpuscles Wenyon and O'Connor mixed perfectly fresh faeces containing large numbers of *E. coli* with a quantity of finger blood; the mixture was placed at once in the warm incubator, and examined from time to time, but no amoebae were found containing ingested red cells. From this experiment it is concluded that "*E. coli* does not readily ingest red blood corpuscles under the conditions of experiment." This is perfectly true, but does not exclude the possibility that under other conditions *E. coli* might ingest red cells. Dr. Macfie and I investigated the point in connexion with an amoeba of the *limax* type.

Large numbers of *Amoeba limax* were mixed with a quantity of finger blood on a slide which was placed on a warm microscope stage and carefully watched; no phagocytosis of red cells was seen to take place. When, however, the *Amoeba limax* was sown on Musgrave and Clegg's medium containing fresh blood, the organisms multiplied rapidly and an intense phagocytosis of red corpuscles took place.

This experiment shows that although under certain conditions *Amoeba limax* will not ingest red cells yet when the conditions are more favourable for the growth and activity of the organism it readily ingests red cells. It is possible that if an experiment could be devised under conditions more favourable to the activity and growth of *E. coli* than those obtaining in Wenyon and O'Connor's experiment it might be found that this organism also was capable of ingesting red blood cells.

My own view is that, at present, there is no character by which it is possible with certainty to distinguish the vegetative stage of *E. histolytica* from the corresponding stage of *E. coli*. I would therefore lay down as a general guide that if entamoebae are found in numbers in the stools of a person suffering from acute, or subacute, dysentery the case should, for purposes of treatment, be regarded as one of amoebic dysentery. *E. coli* may be present in the stools at the beginning of an attack of bacillary dysentery, but as the dysentery continues they rapidly disappear.

The Treatment of Acute Amoebic Dysentery.

In conclusion, I should like to draw attention to the value, in the treatment of acute amoebic dysentery, of bismuth subnitrate in massive doses, as recommended by Deeks from experience gained in the Panama zone. A combination of large doses of bismuth by the mouth, combined with hypodermic injections of emetine, gives much more constant and satisfactory results than emetine alone.

Details of the Treatment Recommended.

A preliminary saline purge is given unless the acute dysentery has already persisted for several days, in which case it is unnecessary.

Emetine HCl, gr. j, is injected subcutaneously, and bismuth subnitrate, ʒ ij or iij, suspended in milk or water, is given by the mouth three or four times daily for a period of twelve days.

Occasionally a morning saline may be necessary if the bismuth causes constipation.

This treatment, in my experience, invariably clears the stools of entamoebae—a result which can by no means be claimed for emetine alone—and causes the disappearance of the symptoms of acute dysentery, the stools speedily becoming less frequent and free from blood and mucus.

I have ventured to introduce these brief remarks on therapy because it appears to me that during the past few years the mass of literature dealing with the use of emetine in dysentery has been so great that the practitioner is in danger of overlooking the value of a drug which, when properly administered in massive doses, is of the greatest value in the treatment of the acute, or the subacute, stages of amoebic dysentery.

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British Medical Journal.

SATURDAY, APRIL 12TH, 1919.

THE OBSTRUCTION OF MEDICAL RESEARCH.

THE "DOGS' PROTECTION" BILL.

THE passage through a Standing Committee of the House of Commons, without amendment, of the so-called "Dogs' Protection Bill" has rudely awakened. to a danger too lightly regarded, every one who in any way realizes the importance of the issues involved, In the *Times* of April 8th Sir Philip Magnus tells how the past master of parliamentary tactics who introduced the bill was able to bring it up for second reading unexpectedly, at the close of a sitting, and to secure, almost without discussion, its reference to a Standing Committee. The Committee was apparently composed in the usual way, mainly of members selected with reference to their political affiliations, without any regard to their competence to deal with an essentially scientific question; three or four medical members were added, and a contingent of nominees of the member in charge of the bill, who could be trusted to know his own supporters. In two short sessions, and with the help of the closure, the bill passed through this Committee without amendment. The next stage will be that it will come before the House for third reading at the next opportunity, which may occur any week.

The effect of the bill, if it should pass into law, is plain enough. It would render any one who made an experiment of any kind upon a dog liable to prosecution. Its enactment would cripple progress, so far as this country is concerned, in some of the most important fields of medical investigation. The whole weight of informed opinion must be brought to bear to prevent such a calamity. Letters of protest and warning have appeared in the *Times* of April 5th, 7th, 8th, and 9th from Sir Edward Sharpey Schafer, Dr. Thomas Lewis, Dr. Leonard Hill, Professor Langley, and Professor Starling. The *Morning Post* of April 7th published under the heading, "A Blow to Medical Science," an admirable statement of the case against the bill. The lay press is fulfilling a valuable function in thus enlightening general opinion.

So far as our own readers are concerned, we are preaching to those who need no conversion, but it may be doubted whether the medical profession as a whole has fully realized its responsibility to the public in this matter. The unscrupulous agitation, which has at length come so perilously near to achieving an instalment of its purpose, has been aided by the prevalent ignorance of the public, and by the power of appeal to a sentiment which is strongly developed in all Englishmen—in medical men as in others. The dog has established a proper claim on man's sympathy and affection, and the public have the right to inquire whether its use for experiment is essential for the progress of medical science, and to be satisfied that the practice involves no significant amount of pain. The materials for assurance on both points are in the hands of every medical man who has thought about the matter and has made himself acquainted with readily accessible facts. The Research Defence Society has done valuable work, but the ordinary man or woman has more confidence in the friend with expert knowledge than in the publications of societies. He has the right to expect that his feelings, harrowed by an insistent campaign of misrepresentation, shall not be treated merely with good-humoured tolerance. The plain facts of the case are easily made clear, and would be accepted by the vast majority of laymen from the medical advisers whom they trust. If lay opinion had not been left so much at the mercy of a mendacious agitation, it is incredible that even a tired and apathetic remnant of the House of Commons would have allowed this bill to pass its second reading almost without discussion.

The part played by experiments on dogs in the building up of medical science, and the necessity of their use for its further progress, are made abundantly clear in the correspondence above mentioned. Each department of experimental medicine has its special needs in respect to the kind and size of animal subjects for experiments. For studying the transmission of infections and for the production of small samples of immune serums the rodents serve well, and are predominantly used. When large quantities of a serum are needed a horse must be used. For research in the domain of physiology, well called the Institute of Medicine, for it is the basal science on which the whole of medicine is built, the smaller animals have less value. For precise investigations into the functions of different organs, for studying the mechanisms of digestion, absorption, assimilation, and excretion, there are certain conditions which the animal subject must fulfil. It must be of suitable size, so that its organs and tissues are neither too small nor unmanageably large; it must be omnivorous, like man, and must resemble him sufficiently in the general structure of its alimentary canal and its digestive processes; it must, for reasons of humanity as well as of convenience, be an animal which can be kept in health, comfort, and cleanliness under the conditions imposed by laboratory investigation. The dog is the only available animal which fulfils these conditions or makes any approximation to fulfilling them.

A very large part of the exact physiological knowledge yet available is based on experiments on dogs, which have been used not because they were easily or cheaply obtained, but because no other available animal would have given the required information. Practically the whole of our knowledge of the function of the heart and circulation, of the formation and movements of lymph, of the secretion of the digestive juices, of the movements of the alimentary canal, of the absorption, assimilation, and metabolism of foodstuffs, of the excretion of waste products, of the function of the ductless glands—practically all had its origin in experiments on dogs. Dr. Lewis, in his valuable letter to the *Times*, shows how the whole of the recent advance in the clinical study of the diseased heart, in which he has himself played so important a part, would have been sterilized and frustrated if concurrent investigations on the dog's heart had not provided the key to the meaning of the complex curves traced by the new recording instruments. As another example, we may mention the recent advance in the treatment of diabetes, which resulted directly from a study of the means of controlling the condition as produced experimentally in the dog. Professor Starling, in a letter to the *Times* of April 9th, pointed out how the advance of surgery, no less than of medicine, has been dependent on experiments made on dogs. "By such experiments it was found possible to excise portions of the alimentary canal, to make openings from one part to the other in order to relieve obstruction, to implant bone or other tissues so as to restore defects, to deal fearlessly with the cavity of the chest, to sew up wounds in the living and beating heart, to restore continuity in wounded blood vessels, and to operate with success on the

brain itself." The number of lives saved and the amount of suffering alleviated during the war as the direct result of these discoveries are beyond all power of computation.

Even if no examples of such immediate application could be quoted, the justification of experiments on dogs would remain intact. So far as medicine is yet a science, it is based on exact physiological knowledge; this knowledge could not have been obtained without experiments on dogs in the past, and its future expansion will be immeasurably impeded if such experiments are now made impossible. That such a blind folly should be contemplated in this country has a peculiar humiliation; for the world has recognized its contributions to physiology, from the days of Harvey, of Mayow, of Stephen Hales, down to the present, as one of the brightest glories of British science.

Public opinion is probably more deeply concerned with the question of the pain, which is alleged to be involved in experiments on animals, than with the value of the information obtained from them. The general ignorance on this aspect of the matter is truly deplorable, for the campaign of calumny has been tirelessly carried on. Popular nomenclature and official formulae have been freely used as aids to misrepresentation. To many of the public "vivisection" means the merciless carving of a sentient creature. The lady who will placidly hand over her cherished cat to be castrated by the coachman or the vendor of cat's meat will denounce with horror the performance of a much less serious operation in the laboratory, with the greatest surgical skill and cleanliness, and under complete anaesthesia. The latter is undertaken for the pursuit of knowledge, and is therefore "vivisection," with all that that word implies. The public do not know that the "vivisection" of which they hear is often the mere feeding of an animal with an experimental diet, its exposure to the atmospheric conditions encountered by the airman or the mountaineer, or a hypodermic injection to which they would submit themselves without flinching. They do not realize that the large majority of the dogs subjected to experiment are killed while still under the full anaesthesia maintained during the whole time the procedure is being carried out, and meet an easier death than any of the thousands sacrificed every week in the lethal chamber of the "Dogs' Home." Certificate A is produced as evidence that "vivisection" without anaesthetics is permitted; and the public do not know, as their misleaders do, that this certificate has never been granted or sought for any procedure more serious than a hypodermic injection. It is surely the plain duty of the medical profession to see that no opportunity of informing them is wasted.

The threatened passage of this bill through Parliament, just as the country is emerging from the bitter years of war, is of ominous significance. Have we indeed learnt nothing, and are we still to be haters and despisers of knowledge? The nation, during more than four years, has given not only the flower of its young manhood, but horses and even dogs, to the daily torture of bombardment by the enemy's high explosive, of suffocation and burning by his poison gases. The immeasurable suffering thus imposed had its justification in the end in view. The medical profession has an end in view—the mastery of pain and disease by knowledge. Is this so mean an aim that it will not justify the sacrifice of a few dogs, with all the safeguards against pain which the existing law affords? Truly this is not a matter affecting only those who are devoting their lives to research; it touches closely the honour of every member of a humane profession. It is a matter, as Sir Edward Sharpey Schafer points out, affecting the Government, which but a few years ago provided the means for a broad scheme of medical research.

When the bill, after passing through the Standing Committee, came before the House on the following day for third reading, the Under Secretary of State for the Home Department (Sir Hamar Greenwood) introduced an amendment which is calculated to mitigate the evil that would be worked by the bill if it were to become law as it left the Standing Committee. The amendment would leave out the words forbidding any person or place to be licensed for the performance of experiments on dogs, and would permit such experiments on the acceptance by the Home Office of an additional certificate showing "that for reasons specified the object of the experiment would necessarily be frustrated unless it is performed on a dog, and that no other animal is available for such experiments." The decision of the House on this amendment has not been taken because the debate was adjourned by the operation of the time rule. We are glad to see this evidence that the Government, and especially the Home Office, realizes its responsibility in the matter. The bill may come up again any week, and meanwhile it is the duty of the medical profession to make its disastrous significance clear to all concerned.

PROTEST BY THE SPECIAL CLINICAL AND SCIENTIFIC MEETING OF THE BRITISH MEDICAL ASSOCIATION.

The serious menace to the progress of medicine by research contained in the Dogs' Protection Bill was brought to the notice of the Special Clinical and Scientific Meeting of the British Medical Association in London this week. As there was no general meeting the opportunity of a joint meeting—with Colonel Haven Emerson, Medical Corps U.S.A., in the chair—of the Sections of Medicine and of Preventive Medicine and Pathology on Thursday, to discuss influenza, was taken to bring the matter forward.

The following resolution was moved by Sir William Osler, F.R.S., Regius Professor of Medicine in the University of Oxford, seconded by Professor C. J. Martin, F.R.S., Director of the Lister Institute, and supported by Sir George Makins, President of the Royal College of Surgeons of England. Colonel Emerson, in putting it, said that though the bill was British the success of faddists here would encourage their kind in other countries. The resolution was carried unanimously.

> **This meeting of the combined sections of Medicine, Pathology, and Preventive Medicine, of the British Medical Association learns with dismay of the possibility of the passage through the House of Commons of a bill to prohibit experiments upon dogs.**
>
> **The anatomical structure and omnivorous habit of the dog, together with the fact that it can be kept in health and comfort under the conditions imposed by laboratory work, render the larger sort the only available subject for experiment in important fields of physiological and pathological investigation.**
>
> **The prohibition of experiments upon dogs would, in the opinion of this meeting, have the deplorable result of hampering the progress of medicine and of rendering Britain alone, among the civilized nations of the world, unable to contribute to progress in a department of medical research in which it has hitherto played a distinguished part.**

A resolution in similar terms was put to the Section of Surgery by the Chairman, Sir Anthony Bowlby, on the proposition of Professor Bayliss, F.R.S., seconded by Dr. H. H. Dale, F.R.S., and carried unanimously.

THE SECTIONS.

THE Special Clinical and Scientific Meeting of the British Medical Association in London this week is a success even beyond expectation. The numbers attending each of the three sections are large, and the debates well sustained, with that spice of frank criticism which gives life to discussion. On Wednesday the physical chemistry lecture theatre was quite filled by those attending the discussion on the dysenteries in the Section of Preventive Medicine and Pathology, while large and appreciative gatherings followed the discussions in the sections of Medicine and of Surgery, held respectively in the big chemical and physical theatres. The opening addresses in the three sections on the first day are published in our present issue, and we print below brief reports of Wednesday's discussions. Full reports will be published later in a special volume containing the proceedings of the meeting. The number of members and visitors who had registered in the Reception Hall at the Imperial College of Science on Thursday morning was over seven hundred.

WAR NEUROSES.

THE meeting of the Medical Section on Wednesday, under the chairmanship of Sir David Ferrier, F.R.S., was very well attended, Lieut.-Colonel Mott, R.A.M.C.(T.), introduced the subject of war neuroses in a paper printed in full elsewhere in this issue of the BRITISH MEDICAL JOURNAL. He was followed by Lieut.-Colonel Hurst, R.A.M.C.(T.), who gave a lucid analysis of the various emotional neuroses and added some results of his experiences at the Seale Hayne Hospital. The general trend of his observations was to show the preponderating part played by hysteria in the production of war neuroses; the test between organic and functional nervous disease should be the response to psychotherapy, and he had found that patients with such suggestive symptoms as urinary incontinence, constant vomiting, constant headache, and recurrent fits might all be suffering from functional disease, whether primary or secondary to cured organic nervous disease. He held most cases of epilepsy in soldiers to be functional. For treatment he advocated explanation and re-education, making the patient take an active part in his cure. Lieut.-Colonel Farquhar Buzzard laid stress on the similarity of the neuroses of peace and war, adding that those of war were easier to treat because their etiology was the more uniform. He proceeded to draw from experience in war lessons of value for peace, advising that the Minister of Health should institute both prophylactic and remedial measures—the training of medical officers to deal with neuroses, the provision of out-patient clinics and a larger number of institutions for its treatment—and he described labour unrest as the war neurosis o a community. Colonel Sir James Purves Stewart devoted himself to pointing out the importance of accurate clinical diagnosis and the clear definition of terms when dealing with that ill-named complex "shell shock" — a term never to be employed again; he gave a classification of neuroses into eight groups. On all hands the frequent occurrence of neuroses in the present war had excited comment; in previous wars our men had been trained and seasoned soldiers, and he expressed surprise that the number of cases of neurosis occurring in our armies during the last five years had been relatively so few. Dr. Yealland gave an account of his work in the National Hospital in Queen Square, and took the opportunity to decry the use of hypnotism and methods of psycho-analysis in the treatment of war hysteria, for the reason that so many patients thus treated arrived later for further treatment in the out-patient department of that hospital. Dr. Johnston gave an admirable account of his treatment of many thousand cases of war neurosis at a specialized casualty clearing station in the front area, and stated that only 1 per cent. of our men fighting about Passchendaele between August and October, 1917, went sick as cases of neurosis. He described the methods of treatment adopted, emphasizing the importance of a healthy moral atmosphere, the segregation of the patients, and the inception of the appropriate treatment as soon as possible. Dr. Dundas Grant spoke of the difficulty of distinguishing organic from functional disease of the ear in many cases of neurosis, and said that he had met with very few cases of simulated deafness. Details of the elaborate system of dealing with cases of war neuroses in the American fighting forces were given by Colonel Zabriski and Major Hamilton, Med. Corps U.S.A.; and Colonel M. Macdonald, N.Z.M.C., gave an interesting analysis of the possible etiology of the contractures seen in patients with war neuroses. Major Ormond, R.A.M.C.(T.), gave an account of some interesting ophthalmological cases in which the diagnosis between functional and organic disease was obscure. Lieutenant Lumsden, R.A.M.C.(T.), laid stress on the importance of following up cases of war neurosis supposed to have been cured, and deprecated the use of the term "cure" until the passage of years justified it. Prevention of relapse was what the sufferers wanted rather than the removal of their neurotic symptoms; the epilepts and borderland mental cases were, in his experience, the most difficult to deal with. Colonel Gordon Holmes, speaking from two years' study of war neuroses in France, described the results of treatment of the functional cases as unsatisfactory on the whole, adding that at the present moment no fewer than 36,000 war-neurasthenic patients were awaiting re-educational treatment. He quoted cases to illustrate the unsatisfactory results obtained by the treatment of hysteria with psycho-analytic methods. Surgeon Lieutenant Beaton, R.N., said that hysteria had never got a footing in the navy, in which cases of neurosis had been rare. Captain Culpin spoke in favour of the use of psycho-analytical methods in the treatment of patients with war neuroses. In conclusion, Colonel Mott replied, commenting on the remarks made by many of the speakers; and so a very successful and illuminating discussion came to an end.

GUNSHOT WOUNDS OF THE CHEST.

AT the first meeting of the Section of Surgery, which took place on Wednesday morning, Sir George Makins, G.C.M.G., President of the Royal College of Surgeons of England, was in the chair, and a discussion took place on gunshot wounds of the chest. The opening papers by Colonel T. R. Elliott, D.S.O., F.R.S., and Colonel G. E. Gask, C.M.G., D.S.O., are published elsewhere in this issue.

The discussion was taken up by Major J. E. H. Roberts, who said that his experience of thoracotomy in a quiet sector, when cases could be treated carefully, was that the results were very good; during a time of stress and with surgeons of limited experience in that class of case, the results were unsatisfactory. He found there was always some clot in the haemothorax; if this was turned out and the pleura cleansed, any sepsis that occurred was generally successfully treated by repeated aspirations, unless haemolytic streptococci were found. He objected to the method of artificially expanding the lung, because of the danger of septic material being driven into the other lung and setting up septic pneumonia.

Major Lockwood was an enthusiastic advocate of operation. In early cases, which formerly had a mortality of practically 100 per cent., he had seen it reduced to 28 and 34 per cent. He recommended that the methods adopted in these early cases should be applied to late cases where there was collapse from any cause, or where there was a chronic discharging fistula. Where the missile in the lung was not large the cases should be left alone. He made a plea for local anaesthesia, as it diminished the risk of shock. In these late cases, where the object was to

improve the general health, operation should not be too readily undertaken; the case should be carefully studied beforehand in conjunction with a radiographer.

Colonel Barling, C.B., felt certain, from experience of cases of septic haemothorax at the base hospitals, that by operation the period of convalescence was shortened. Unfortunately the great majority of cases had to be drained and the pleural cavity irrigated, generally for three or four weeks, before closure could be attempted. A small number of cases might be selected for primary suture; they could be recognized clinically by the fact that they ran a mild course, the temperature being the only indication of the presence of septic material. From the point of view of the bacteriology immediate closure could be done unless streptococci were present. These cases perhaps required a few aspirations afterwards. The problem at the base hospitals was largely one of overcoming pleural as contrasted with pulmonary sepsis.

Colonel A. B. Soltau, C.M.G., doubted whether the results of surgery were very striking. He did not think that the theory of Colonel Elliott with regard to bronchial spasm met the condition, for there were seldom any clinical signs of it. He offered the alternative suggestion of reflex paralysis of the muscles controlling respiration, and pointed out how often painful tonus of the abdominal muscles was found on the affected side. This tonus he regarded as an effort of nature to enable the lung to close down and arrest haemorrhage.

Sir John Rose Bradford dealt with the question of massive collapse. In the simplest form it occurred in contralateral collapse, in association with non-penetrating wounds of the chest, generally of an extremely trivial character. This occurred without serious symptoms, and developed quite early. In the first stage nothing could be elicited except weakness in the breath sounds. This was followed by loud tubular breathing, and in the third stage by the presence of adventitious breath sounds. It might last for a very considerable time without causing much trouble. There was no explanation available at present, but they trusted to laboratory research to settle the question. He considered that this massive collapse was present in every case of chest wound on the affected or unaffected side, or on both.

Miss Frances Ivens said that she had had experience of 166 cases, with a total mortality of 9 per cent. Of these 70 were perforating wounds and 96 penetrating; 84 were operated upon or aspirated. She found that by far the most successful cases were those in which complete and early operation was done on the lines indicated by Colonel Gask, with closure of the wound. A certain number of these cases, however, developed empyema, and she had adopted the plan of irrigation by the Carrel method until a bacteriological report was negative. The same treatment, in conjunction with large doses of antigangrenous serum, was adopted where anaërobic organisms were present. It was most important to have close co-operation between physician and surgeon.

Mr. Maynard Smith, C.B., contrasted the condition of chest cases as found at the base and the casualty clearing stations. The first success that surgery had was in dealing with sucking wounds, a condition incompatible with life. When the idea was adopted at the field ambulances of roughly suturing these wounds they arrived at the casualty clearing stations in an infinitely better condition, and later, with the removal of all damaged areas and the application of general surgical methods, there was no question that there was a considerable diminution in mortality.

Dr. Finzi said that the work of the radiologist consisted mostly in making screen observations of the movements of the diaphragm, the presence and movements of foreign bodies, the position of the heart, and the presence and distribution of opacity in the chest. He gave a radiographic demonstration of various conditions found in chest injuries.

Sir Anthony Bowlby traced the progress of surgery of the chest during the war. It was not till 1916 that the treatment of wounds by excision was commenced, and not till 1917 that it was applied to chest conditions. There was no doubt of the great improvement that resulted by operation, especially when repeated aspirations were done after operation. It had to be admitted, however, that sometimes unsuitable cases were operated upon. In 1918 surgery of the chest was placed upon a sounder basis, and it was found that about one-sixth of all cases were capable of being improved by operation. Among 608 cases admitted to a special hospital at Rouen the mortality sank to 2 per cent., and very few previously operated upon at the casualty clearing stations had to be reopened for sepsis. He wished to learn the later effect of large and complicated haemothorax.

Colonel J. W. Smith, in reply to the request of the Chairman for experience at home of the later condition of cases with retained foreign bodies in the lungs, said that in the majority the discomfort and disability was not great, and removal of the projectile was not advisable.

Sir Berkeley Moynihan said that in many of the cases in which a projectile was retained in the lung the patients complained of pain, disinclination for active exertion, and sometimes haemoptysis. He decided to operate on some of these cases, and at first looked upon the removal of the foreign body as the prime object; that was easy, and the majority of missiles were sterile. Afterwards he found, however, that the great lesson to be learned was the advisability of the liberation of the lung from its embarrassing entanglement of adhesions. When the lung was thus freed the condition was undoubtedly immensely improved. He gave brief details of the technique adopted.

Sir George Makins, in closing the discussion, called attention to the fact that Sir William Macewen years previously had pointed out the principles on which thoracotomy could be done without having recourse to the cumbersome apparatus of closed chambers. In reflecting on the claims of foreigners to have advanced thoracic surgery it would be unbecoming not to pay to Sir William Macewen the credit due to him for his great pioneer work. With regard to the question of bronchial spasm in collapse, he threw out the suggestion that the condition of vascular stupor, so well recognized in the limbs, for example, might be reproduced in the conditions of pulmonary vessels in chest wounds. He had no doubt that immense advances had been made by surgery in cases of gross damage to the chest and in closing the thorax; but he was doubtful if a simple haemothorax of moderate size should necessarily be treated by operation.

The Dysenteries.

At the opening meeting of the Section of Preventive Medicine and Pathology on Wednesday, Colonel C. J. Martin, F.R.S., took the chair in the absence of Colonel Cummins, A.M.S., detained by duty abroad. The subject was placed before the meeting by Colonel L. S. Dudgeon, C.M.G., who dealt with bacillary dysentery, and Professor Warrington Yorke, who dealt with amoebic dysentery in England. These papers are published in full elsewhere in this issue. There was a large attendance and the discussion discovered some differences of opinion, especially amongst the bacteriologists who have been working on different fronts, as to the variety of Shiga bacilli concerned; while Professor Yorke's investigations on indigenous amoebic dysentery amongst civilians and recruits raised important questions as to the possibility of an

epidemic arising in this country. Sir William Osler, referring to the mild character of the cases of amoebic dysentery admitted to English hospitals, said that hepatic abscess had been rare; this he attributed to the beneficial effect of the emetine treatment. Colonel Haven Emerson, Medical Corps, U.S.A., said that cases of amoebic dysentery or carriers discovered in the American Expeditionary Force were, with rare exception, men who had served in the Philippines or who lived in southern states, where amoebic dysentery was not uncommon. Among about 1,500 cases of clinical dysentery carefully studied for strains of bacilli, the same groups of bacilli were found in the main as were reported by the pathologists of the British Expeditionary Force. Captain Stokes, D.S.O., R.A.M.C., dealt with some points in the history of dysentery in France. He said that the infection in the Somme epidemic was from German sources; but there was a more generalized spread in 1917, especially in territory which had been occupied by the Germans. Lieut.-Colonel Duncan Graham said that he had found serum therapy more effective in dysentery due to the Shiga bacillus than in that due to the Flexner group. Captain Murray discussed the relation of dysentery bacilli, and Dr. F. W. O'Connor, of the London School of Tropical Medicine, dealt with the importance of incidence due to the fly. Major Ellis, C.A.M.C., questioned the value of the evacuation of diarrhoea cases from an army; and Colonel L. B. Wilson, Medical Corps, U.S.A., uttered a note of warning as to the risk of overlooking typhoid fever in searching for dysentery bacilli. Major-General Sir William Leishman, K.C.M.G., A.M.S., spoke of the importance of experience and new knowledge accumulated during the war in connexion with every branch of the subject. The discussion showed that there still existed considerable divergence of opinion on certain points, which could only be resolved by the final analysis and study of all the reports. Dr. Ramsbottom, O.B.E., stated that amoebic dysentery was probably endemic in Macedonia, though it had been believed to have occurred only in troops from Egypt or Gallipoli. He also discussed the treatment of cyst carriers; and Colonel Faichnie contended that more attention should be given to infection by means of the excrement of flies. Colonel Dudgeon and Professor Yorke replied briefly on the points raised in the discussion.

DEMONSTRATIONS.

Nervous Diseases.

One of the first of a series of clinical demonstrations arranged in connexion with the Special Clinical Meeting of the Association was held at the National Hospital for the Paralysed and Epileptic, Queen Square, on Wednesday afternoon, April 9th. The medical staff of this hospital had collected a series of interesting and instructive cases, illustrating some of the rarer forms of nervous disease as well as certain nervous conditions produced by gunshot and other wounds.

Dr. Howard Tooth exhibited a long-standing case of tabes dorsalis in which extensive wasting of the shoulders and upper limbs had come on during the past six months; so that in addition to the ordinary signs of tabes there was extensive atrophy of the supraspinati, deltoids, triceps, supinator longus, and long extensors of the wrists and fingers, as well as of the intrinsic muscles of both hands. The amyotrophy consequently corresponded roughly to segmental distribution. Each of the two cases of syringomyelia shown also presented interesting features; that under the care of Dr. Risien Russell was in a relatively early stage, but Dr. James Taylor's case had been under observation at the hospital for many years; she is now bed-ridden, and has very little power of movement in the arms. In this woman the disease had extended to the brain stem, and produced extensive cranial nerve palsies and very pronounced nystagmus. Cases of myasthenia gravis were also shown by Drs. Taylor and Russell. One of Dr. Taylor's patients was especially interesting, as in him this disease was associated with symptoms of exophthalmic goitre. In another case the disease was manifested chiefly by recurrent ocular palsies, which had repeatedly recovered spontaneously.

Tumours of the central nervous system were well represented. Dr. Farquhar Buzzard exhibited one of the fronto-cerebellar angle which probably grew from the acoustic nerve, and presented the characteristic symptoms of a growth in this region. In one of the patients shown by Dr. Gordon Holmes a large endothelioma had been removed a fortnight previously by Colonel Percy Sargent from the right fronto-central region. This woman's history was interesting as the first evidence of disease was a localized Jacksonian fit, which occurred as she was hurrying out of bed on the warning of an air raid in June, 1918. It was only later that she began to suffer from headaches, and developed optic neuritis and a slowly progressive left-sided hemiplegia, which was already beginning to disappear within a fortnight of the removal of the tumour. In another case, shown by Dr. James Taylor, the beneficial effects of decompression when the tumour is not removable was well illustrated.

Another happy result of surgery of the central nervous system was seen in a case exhibited by Dr. Grainger Stewart and Colonel Sargent. The woman had presented for eight months symptoms of slowly progressive paraplegia and deficient sphincter control; after the removal, five weeks ago, of a tumour which had compressed the first thoracic segment of the spinal cord the functions of the sphincters had become normal, and the patient was again able to walk. In a second case, which had been under the care of Dr. Hinds-Howell, the removal of a tumour from the same region by Colonel Sargent had an equal happy result.

The surgery of the peripheral nerves was represented by a series of cases, demonstrated by Colonel Sargent, of primary and later suture, and of the effects of the insertion of grafts when it was found impossible to bring the ends of the nerves together for end-to-end suture. The effects of various injuries inflicted during the war were also illustrated by cases demonstrated by Dr. Gordon Holmes. Of these perhaps the most interesting was a stab wound of the lower dorsal segments of the spinal cord, which produced an extraordinarily pure Brown-Séquard syndrome. The knife entered between the laminae of the ninth and tenth thoracic vertebrae and injured the right side of the cord, with the result that the man developed immediately paralysis of his right leg and of the lower muscles of this side of the abdomen, which is now recovering; on this side he had also, during the first four or five weeks, burning and lancinating pains and intense hypersensitiveness to all peripheral stimuli. The original sensory changes remain unaltered; his left leg is insensitive to all painful and thermal stimuli, while in the right limb the sense of position is lost, and the appreciation of vibration, of movement, of shape, and of the compass points in Weber's test is abolished. This is consequently one of the rare cases of stab wound of the spinal cord so valuable in enabling us to analyse and determine the intramedullary paths by which afferent sensory impressions are conducted through the central nervous system.

In a second case, shown by Dr. Gordon Holmes, the symptoms indicated a lesion of the left side of the mid-brain. The man, who was blown up by a shell explosion a year ago, had paralysis of the left superior oblique, and complete loss of pain and thermal sensibility on the whole of the right side of his body, while his left limbs were ataxic and tremulous in movement and at rest. There was, however, no paresis on either side, and the reflexes were normal. His gait had the drunken, staggering character that is produced by cerebellar lesions; his speech was indistinct and ataxic, and nystagmus developed in movement of the eyes in all directions. A radiograph

revealed a doubtful fracture of the posterior fossa of the skull. The lesion was probably due to a direct blow on the head. Dr. Gordon Holmes showed also a soldier who was wounded eighteen months ago by a fragment of shell that passed through the cerebellum. The case illustrated most of the symptoms of a cerebellar injury of moderate degree though he had no nystagmus. Among other interesting cases shown were two brothers with Leber's hereditary optic atrophy, under the care of Dr. James Taylor. In each of these, *x*-ray photographs of the skull showed considerable enlargement and other changes in the sella turcica; this is particularly interesting in view of Mr. J. H. Fisher's suggestion that such cases of optic atrophy associated with signs of retrobulbar neuritis may be due to enlargement of the pituitary gland.

In a few of the cases demonstrated a definite diagnosis had not been reached. In a boy who was shown by Dr. Risien Russell the chief symptoms were progressive stiffness and weakness of various groups of muscles; another member of this family was somewhat similarly affected. A case of Dr. Buzzard's was characterized by frequent or continual clonic and tonic spasms of groups of muscles on one side of the body, which began in the region of the head and spread gradually to the limbs and trunk of this side. These spasms ceased in sleep. As his condition had not been influenced by repeated and vigorous suggestions and other psychotherapeutic measures it is improbable that they are purely functional, as was at first suspected.

MINE GAS POISONING AT THE WESTERN FRONT.

ON Wednesday afternoon Lieut.-Colonel D. Dale Logan, D.S.O., R.A.M.C., gave a demonstration of mine gas poisoning at the Western Front, showed the rescue apparatus, and explained the organization. Most people, he said, associated gas poisoning with the second battle of Ypres, when drift gas was used for the first time, and the subsequent use of gas shells, which grew more and more intense and caused serious casualties to both sides. Few, however, realized that in the use of what might be termed the legitimate weapons of modern warfare, in which explosives were used, thousands of casualties resulted from poisoning by carbon monoxide. A very large proportion of these were due to shells, bombs, and aërial torpedoes bursting in dug-outs, subways, cellars, concrete structures, and enclosed places, but many cases occurred in mining. On the Western Front mining was started early in 1915; the great struggle round Hill 60 in April of that year was fresh in memory. By the autumn of 1915 mine warfare had made huge strides, and, with the great increase in size of the explosive charges used, more extensive mine systems, and the fact that thousands of men were employed underground, the casualties from gas poisoning assumed serious proportions. As many of the men were skilled miners, whose places it was almost impossible to fill at the time, the wastage was affecting the efficiency of companies.

From the early ages mining was common in siege warfare. After gunpowder was discovered and used in mining, about the middle of the sixteenth century, a train of symptoms following exposure to the fumes became recognized. In France these were grouped under the term *mal des mines*, and the peculiar mental condition met with in men who regained consciousness was graphically described as *l'enivrement par la poudre*. A German commission which inquired into the large number of casualties caused by gas poisoning in connexion with war mines reached no satisfactory conclusion regarding prevention and treatment, but it advised the use of pigeons as indicators of danger. It appeared to be quite unknown to the mining world that pigeons and rats were used as gas indicators centuries ago. [The speaker then gave a description of mining, of the ventilation of mines, and examples of the rescue of men who had been entombed for days.] He had, he said, been attached by the D.G.M.S. to the staff of the engineer-in-chief in September, 1915, in order to organize a system of rescue work and of protection against gas in mining. The insidious nature of the poisoning and the serious number of casualties lent support to rumours floating round tunnelling companies about the enemy employing a new gas and forcing it through into our galleries. From investigations of conditions underground after a blow, the manner in which casualties occurred, the detection of CO in the blood of men a few minutes after they had been rescued, the *post-mortem* examination of a number of men, and of canaries killed by gas, there was no difficulty in coming to the conclusion that CO from the detonation of explosives was the poisonous factor in mine fighting. The opportunities the enemy could have to force CO gas successfully into our galleries were so rare that this source of poisoning could be ignored. Orders were immediately issued for avoiding the more obviously preventable sources of accidents. Some of these were due to ignorance of the action of CO. For example, a number of fatal accidents had occurred owing to men who had been slightly gassed making their way out by climbing the vertical ladder in the shaft or walking up a steep incline, thus greatly increasing the demand on the already impoverished content of the blood; this resulted in loss of consciousness and the men fell to the bottom. Orders were at once circulated that no man, however slightly gassed he might seem, should ascend the shaft without being roped and hoisted. The difficulties and dangers of this method of bringing up an unconscious man, the constriction of the chest and the serious effect this must have had in certain cases, the dangers of the rope slipping, and also the great exertion entailed in hauling a man along the galleries, led to the introduction of the mine stretcher, designed by Lieutenant Penman, which proved of such value.

The danger of entering an atmosphere in which a man could walk a certain distance before perceptible symptoms of poisoning developed was not appreciated. A considerable percentage of the casualties were among men who rushed in without apparatus to rescue their comrades. The restricted length of galleries as compared with collieries at home was a great temptation to the men to attempt rescue without apparatus. The order "No man is to descend the shaft without rescue apparatus till the mine is reported clear of gas" resulted in a noticeable decrease in the number of casualties. The fact that the knowledge of explosives possessed by most people was vague probably explained the wonderful stories of discoveries of new explosives of extraordinary power circulated from time to time, such as that which went the round in the first few months of the war, of a French explosive which detonated with such extreme violence that Germans within a few hundred feet were killed, their bodies being frozen stiff with not a mark to be seen. Soon after America entered the war we were regaled with stories of a new American explosive, a teaspoonful of which would uproot St. Paul's Cathedral. After the great battle of Messines, when nineteen huge mines were blown by the British, one famous war correspondent made the statement, which aroused considerable hilarity among tunnelling companies, that one pound of ammonol, the explosive used, could blow the Mansion House to atoms. Tales of a similar nature appeared during the Russo-Japanese war.

Colonel Dale Logan next discussed the constitution of explosives, the different types used in the war, and the products of combustion, with particular reference to those used in mining, and how gas poisoning was produced in mining. The intensity of the mine warfare waged could be gauged by the fact that in 1916 the enemy fired 700 mines and camouflets, and we fired nearly 750. At the battle of Messines, when mining contributed so much to the success of operations, some mines were charged with over 90,000 lb., and the total charge in all the mines was considerably over one million pounds. Several of the mines had been laid for twelve months and many for nine

months, and that they were still effective when required showed how carefully the charges had been laid. The result was due to many months of strenuous silent watching and working of a particularly nerve-racking character, and in order to preserve the mines until the great moment arrived much underground warfare and crater fighting was waged and many mines and camouflets blown. The character of the work underground entailed considerable nervous strain both for officers and men. Listening under certain conditions was particularly nerve-wearing, and at the same time most hazardous. From the time the listener began work his nervous system was in a state of tension more exhausting than work. To this must be added the deadly monotony and loneliness of the work and the necessity for absolute silence. Few could realize what silent working meant, and it was difficult to estimate the strain on the men, more especially as they were carrying out very arduous work all the time. The slightest noise might result in such serious consequences and have such far-reaching effects that every man had to concentrate his attention on working in perfect silence. The effect of intense concentration of the mind in causing early fatigue was well understood; and when this acute concentration was carried on during working hours for many months, as it was in silent work in the mine, it must be considered an important factor in the incidence of nervous affections in the miners.

The possibilities of gas poisoning of the infantry in the crater fighting, which was one of the most important features of the stationary trench warfare of 1915 and 1916, were then discussed, and the methods adopted to prevent gas poisoning of the infantry who went through the huge craters at Messines battle a few minutes after they were blown, described. The gases from the detonation of a high explosive included CO, H, and CH_4, all combustibles, and, when present in the proper proportion, explosive. How these gases were produced, the phenomena of an underground explosion and its results, and the methods adopted to prevent them, were described. Lastly, the speaker gave a description of the rescue organization in France, the training in the schools, rescue work in the trenches, and its dangers and difficulties. Much useful work, he said, was done "after blows" by mine rescue men in restoring ventilation, clearing galleries which had been wrecked, taking out tamping, etc.; and two instances were cited in which mines were charged and tamped by men wearing apparatus. A demonstration of the use of mine rescue apparatus was also given.

Injuries to Blood Vessels.

At the Royal College of Surgeons, on Wednesday afternoon, the President, Sir George Makins, gave an epidiascopic demonstration of injuries to blood vessels. The results of contusion of arteries with thrombus formation were shown macroscopically and microscopically, and the changes that occurred previous to and following secondary haemorrhage. Arterial haematomata or false aneurysms, true arterial aneurysms, aneurysms showing a blockage by surrounding structures, and arterio-venous aneurysms were very fully demonstrated.

Bone Inflammation and Bone Repair.

A collection of specimens of bone inflammation and bone repair, made by Major L. G. Rhea, until recently pathologist to No. 3 Canadian General Hospital, Boulogne, who has returned to Canada, was demonstrated on his behalf by Colonel J. G. Adami, F.R.S., C.A.M.C., at the Royal College of Surgeons of England on Wednesday afternoon. The bone lesions coming under observation had been minutely studied, and full clinical histories of each case were given. Observations of the position of the bone fragments at operation, in the laboratory, and in the *post-mortem* room were carefully detailed. This necessitated many photographs, accurate measurements, and drawings. Apart from the interest attaching to the work of specimen making, these observations were calculated to further our present knowledge of bone inflammation and bone repair, particularly as to the paths of spread of infection in fissured fragments, as to callus formation, and the results of mutual pressure in apposed bones. Colonel Adami directed particular attention to those specimens illustrating fracture of the femur and inflammation of the knee-joint.

Diseases of the Respiratory System.

A demonstration of cases of diseases of the respiratory system was given at the Brompton Hospital for Consumption and Diseases of the Chest on Wednesday afternoon. Dr. Dundas Grant showed cases of tuberculosis and other diseases of the air passages; Dr. Cecil Wall cases under treatment with breathing exercises, of chronic hydropneumothorax, and cholesterinous pleural effusion. Dr. Fenton demonstrated two cases of pneumothorax, and Mr. Warren cases of bronchiectasis after operation. Dr. Batty Shaw showed a series of cases, including one of dermoid of the mediastinum, an instance of cardiac hypertrophic osteo-arthropathy, and a case of non-tuberculous apical disease. He and Dr. Melville also gave a demonstration in the *x*-ray department, and Dr. Inman in the pathological department. Dr. Burrell, among other cases, showed some of artificial pneumothorax.

THE POPULAR LECTURE.

The Casualty Clearing Station at Work.

Major-General Cuthbert Wallace, C.B., C.M.G., delivered the Popular Lecture of the British Medical Association, entitled "A Casualty Clearing Station at Work," at Queen's Hall on April 9th, when the chair was taken by Lieut.-General Sir John Goodwin, K.C.B., Director-General Army Medical Service, who said that General Wallace had been in France during practically the whole of the war, and few men had had as many opportunities of seeing the work of the Casualty Clearing Stations on the Western Front. The Clearing Station was probably the most interesting medical unit that had functioned during the war, because its work was so new; and General Wallace had seen it both under stationary conditions and conditions of advance and retreat.

Major-General Wallace first explained the reason for the constitution of the Clearing Station, and traced its history in the early parts of the war. During the retreat in 1914 it failed to function, but came into being again at about the time of the battle of the Aisne. Its modern history, however, commenced when the British armies moved to Flanders and the line became fixed. The function of the Clearing Station then began to change, and many alterations in equipment were made. At first only urgent surgery, such as a military surgeon thought possible at the front, was undertaken; it was interesting to note that antiseptics were used from the commencement. As time went on surgery passed more and more from the Field Ambulances to the Clearing Stations. This was a wise decision on the part of the authorities, because surgeons were very limited in number; in fact, many of them had to be trained during the war. It was necessary, therefore, to concentrate the surgery if it was to be done at all efficiently. In November, 1914, nurses and beds were added to the Clearing Station, and at about this time, too, dentists were appointed.

There was little further alteration until the spring of 1915, when wounds began to be treated by opening up and drainage. At the battle of Neuve Chapelle each Clearing Station only had one table, and the greater part of the wounded passed to the base without operation. The expectant treatment of wounds of the abdomen was the method followed, except in a few instances, down to June, 1915, when operation became more general. The number of operation tables had been doubled at this period, which saw also better surgery of wounds and the introduction of

the hypochlorites as antiseptics. Trial was made of a greasy antiseptic paste for application to the wound soon after its receipt, but it could not be said that this was a success. At the battle of Loos the number of wounded received was so large that the lessons learnt could not be put into practice, but one thing it taught was that more operating facilities must be arranged and more surgeons provided. During the winter of 1915–16 the wound treatment improved; wounds were more freely opened and the practice of excising the damaged tissues became general. June, 1916, saw the introduction of the Carrel method, and bipp arrived soon after. At the Somme battle most clearing stations had three tables, a staff of about sixteen medical officers, and as many nursing sisters. It was at this time that surgery of the chest commenced. Altogether it might be said that the wounded arrived at the base in a far better state than from any earlier battle.

Towards the close of 1916 primary suture of wounds was commenced in a quiet portion of the line, and gradually made its way until early in 1917 in quiet times it became the practice. April saw the battle of Arras and Vimy, and the introduction into front-line work of Thomas's splint, which had been used in Clearing Stations as early as the summer of 1915. Throughout 1917 the excision of wounds became better and better understood, and treatment was facilitated by the fact that the pathology of gas gangrene had been worked out. The same year saw also the introduction of flavine and the numerous aniline dye pastes. By that date nearly every conceivable antiseptic had been used up and down the line. The wounds had done better and better, but the one constant factor was improvement in the excision and mechanical cleaning of the wound. It was to this more than to any antiseptic that the better results were to be traced. The year closed with the battle of Passchendaele, in which the French introduced the delayed primary suture of wounds. This was an extremely successful experiment, and the results, it should be noted, were obtained without the use of chemicals. The Clearing Stations had become larger and larger, a stereotyped plan had been evolved, in which by the arrangement of lashed tents the work was greatly facilitated.

So big had Clearing Stations grown that attention had to be turned to the problems of moving warfare, which most people saw was inevitable. In the spring of 1918 came the great retreat, and during this time surgery was largely transferred to the base. With the stabilization of the line Clearing Stations again made their appearance. On August 9th commenced the British advance, and from that time to the end of the war a tremendous strain was placed on the medical organization to keep up with the retreating Germans. Bad roads, lack of transport, and the interruption of railway communication, rendered the moving of Clearing Stations extremely difficult, but on the whole they were kept within a fairly reasonable distance; in some cases they were actually ahead of the railhead, so that the patients had to be evacuated as far as twelve or sixteen kilometres to the ambulance trains. The need of mobility made it necessary to give up a great deal of the previously accumulated impedimenta, and it soon became obvious that the Clearing Station could do its work without all the elaboration that had grown up.

Major-General Wallace then gave some figures showing the number of men operated on, and how, owing to the dearth of medical officers, the desired percentage of operations had never been reached. He also gave some details about the number of medical units and medical officers, and explained the more intimate working of the Clearing Station at the period when the war ceased.

Finally, he declared that preventive medicine had really done much more for the soldier than surgery. If typhoid had raged in the armies of the combatants as it had in the British troops in South Africa, the Great War would have ceased long since. In South Africa there were 73,633 cases with 10,144 deaths; in the present campaign there had been 7,423 cases and 266 deaths. There had been, therefore, fewer cases in France than there were deaths in South Africa.

The lecture was illustrated by lantern slides showing the details of transport and clearing of the wounded.

Lieut.-General Sir Charles Burtchaell, D.G.A.M.S., France, proposed a vote of thanks to General Wallace, and said that the history of the Casualty Clearing Station was intimately bound up with the development and progress of medical and scientific knowledge during the war. From the time these stations began to be used on modern methods, they were the centres of scientific interest in the war area. Criticism had been passed upon what people considered the exorbitant number of medical officers who were required in France. But in times of battle it had been said truly that it was impossible to have too many surgeons, and in non-battle times the surgeons must almost necessarily be too many. That was a point which critics in this country did not understand. It was imperative in war to keep large numbers of medical men standing by in case of emergency. He paid a tribute to the medical officers of the army and also to the non-commissioned officers and men and nursing sisters, to the Red Cross and the Order of St. John, and to the Medical Research Committee. Never previously had the medical profession such freedom of action and such general support as it had enjoyed during this war, and it had taken full advantage of its opportunities.

The vote of thanks to General Wallace was accorded with acclamation.

RECEPTIONS.

By the Metropolitan Counties Branch.

On the evening of Tuesday, April 8th, a very successful reception was held at the historic Guildhall in the City of London, kindly lent for the purpose by the Lord Mayor. This entertainment, provided by the Metropolitan Counties Branch of the Association, gave an opportunity for many visitors to renew acquaintanceships broken by the war, or meet the womenfolk of friends made on active service. The guests were received in the great hall by Sir T. Clifford Allbutt, President of the British Medical Association, and Dr. M. G. Biggs, President of the Metropolitan Counties Branch. After this they were free to enjoy themselves according to their bent. Two concerts were given in the Council Chamber, while throughout the evening there were to be found in the Art Gallery what the Victorian poet described as "the dancers dancing in tune," the tunes being provided by the Royal Artillery String Band. For those of an antiquarian turn of mind various attractions had been arranged. Mr. G. Q. Roberts, secretary of St. Thomas's Hospital, gave two lectures on "Old London," with special reference to the development of the London hospitals; they were illustrated by lantern slides from old prints and maps. Dr. A. C. Dove took parties on a tour of inspection of the Guildhall, pointing out the many features of historical and artistic interest. On the dais in the great hall were to be seen collections of surgical instruments used by John Hunter, John Abernethy, and Lord Lister, and other specimens, lent by the Royal College of Surgeons of England and the medical school of St. Bartholomew's Hospital. The visitor who took up a position at this end of the great hall looked down on a kaleidoscopic scene, in which uniforms and gowns of various kinds played a considerable part. The whole evening was greatly enjoyed, and praise is due in particular to Dr. Reginald Morton for his successful organization of the entertainment, which formed an agreeable introduction to the serious business of the three following days.

By the Royal Society of Medicine.

On Wednesday evening a reception was given to those attending the meeting by the Royal Society of Medicine. The guests were received in the library by the President,

Sir Humphry Rolleston, K.C.B., and Lady Rolleston. The programme included music by Mr. Frank Ivimey's string band, and an entertainment by the members of the Savage Club, under the direction of Mr. Charles Collette, in the Robert Barnes Hall. During the evening rare books and objects of interest were displayed in the library; these had been arranged by the honorary librarians, Dr. Raymond Crawfurd and Mr. W. G. Spencer. In the west lecture hall Dr. George C. Peachey gave an interesting demonstration on book plates of medical men, illustrated by lantern slides. Subsequently Dr. Louis Sambon gave a cinematographic demonstration of films lent by Dr. Comandon of Paris, showing Brownian movements of colloids, and various tropical haematozoa.

THE EXHIBITION OF DRUGS AND MEDICAL APPLIANCES.

AN exhibition of surgical instruments, hospital furniture, drugs, foods, sanitary appliances, publications, and other things likely to interest the medical visitor has been displayed at the Imperial College of Science in the Physics Examination Hall. Sixty-five stands were allotted, and a few of the exhibits have overflowed into a waiting hall outside. The full and interesting and up-to-date displays are a tribute to the resourcefulness of the manufacturers and the recuperative power of British industry, particularly in glassware and fine work in metal. In these narrow aisles the visitor is less aware of curtailment and restriction of output due to war conditions than of a creditable adaptability to new occasions and a striking out upon fresh enterprise. This is particularly the case in two directions at least in which the war has suggested new developments or even demanded them. One of these is in the designing of orthopaedic appliances and artificial limbs, and in the furniture and fittings of the hospital ward and operating theatre. The other is in the manufacture of equivalents for German synthetic preparations.

One of the most interesting features of the exhibition, indeed, is a display revealing the stages in the manufacture of kharsivan and neo-kharsivan, which replace salvarsan and neo-salvarsan, and that is only one of several examples of the kind. On another stand is to be seen, for instance, a specimen of chloralformamide, together with its parent substances, anhydrous chloral and formamide; and on yet another a bacteriological peptone to take the place of Witte's peptone. It must be said that the manufacturers have spared no pains to demonstrate to the visitor as far as may be possible not only the product but also the nature of the process by which it is made. The fine chemicals and alkaloids replacing those of enemy origin are particularly prominent.

The *x*-ray and electro-medical apparatus occupies a considerable amount of space in the exhibition, although it is only contributed this year by seven or eight firms. Among so much that is bulky the eye is first captured by the smallest exhibit of all. This is the small Coolidge *x*-ray tube, the American introduction, with a bulb only 3½ in. in diameter. Beside it is another standard type Coolidge of twice the diameter. The *x*-ray couch has been greatly modified as a result of actual experience in the field, both as to giving easy and full adjustments in the examination and to protecting the operator. It is gratifying to note the increasing prominence given to stereoscopic *x*-ray work. A large proportion of the stands is devoted to medical publications, including, at Stand No. 29, the publications issued by the British Medical Association. The relative scarcity of war literature and the number of new editions of standard works are striking. A tempting stand calls attention to the brine baths of Droitwich, under the legend "Now the German Bads are taboo, the English spas will come into their own"; and elsewhere in the exhibition the praises of Malvern waters are sung, and from across the Channel is to be caught the sparkle of Vichy-Célestins. The proprietary foods, sanitary preparations, sterilized dressings, and laboratory equipment appear in abundance, but all these, together with such exhibits as those of oxygen apparatus (including the Haldane apparatus for therapeutic administration) must be left for the detailed review of the exhibition which will appear in a later issue.

SIR AUCKLAND GEDDES.

THE acceptance by Sir Auckland Geddes of the invitation to become Principal of the McGill University was formally announced by the publication on April 5th of letters which have passed between him and the Prime Minister. In thanking Mr. Lloyd George for the confidence reposed in him, Sir Auckland Geddes said that he would never forget how in the anxious days of last year the Prime Minister appeared to rely implicitly on the judgement and efficiency of the Ministry of National Service. "That that reliance was not misplaced," Sir Auckland Geddes continued, "was not due to me, but to the capable and devoted helpers who surrounded me. . . . The country has not yet realized what it owes to them, but some day I suppose the story will be told." Mr. Lloyd George, in his reply, cordially endorsed everything Sir Auckland Geddes had said in regard to the Ministry of National Service, and added that despite the difficulties it had encountered the department had won the confidence not only of the Government but of the people of the country. Sir Auckland Geddes will for the present continue his duties as Minister of National Service and Reconstruction, and has undertaken also to discharge those of President of the Board of Trade during the indisposition of Sir Albert Stanley. It is understood that Sir Auckland Geddes will begin his new duties in Montreal next autumn; his connexion with the university has never been severed, though he has been on leave from his chair since 1914. He served in the South-African war as a lieutenant in the Highland Light Infantry, receiving the Queen's medal with four clasps. He began duty in this war on the east coast of England, served in France in 1915 and 1916, and was promoted brevet lieutenant-colonel for gallant and distinguished conduct in the field. When, in August, 1917, it was decided that recruiting should be placed under civilian control Sir Auckland Geddes was appointed to be Minister of National Service; he received the K.C.B. and was elected to represent the Basingstoke Division of Hampshire in the House of Commons. For a short time last year he held the office of President of the Local Government Board in addition to that of Minister of National Service. When Dr. Addison was appointed to the former office after the general election Sir Auckland Geddes, while continuing as Minister of National Service, became also Minister of Reconstruction. He was one of Sir William Turner's pupils at Edinburgh, became demonstrator and afterwards assistant professor there, was next professor of anatomy at the Royal College of Surgeons in Ireland, and then accepted the chair of anatomy at McGill.

DISABLED PENSIONERS: TEMPORARY AND PERMANENT.

THE Minister of Pensions (Sir Laming Worthington-Evans) announces that it has been decided to decentralize the administrative work as far as possible. In thirteen regions a self-contained administrative unit will be set up, with a director and an advisory council. Among the divisions of the regional office will be a medical service branch, under a regional commissioner of medical service. The medical staff has been taken over from the Ministry of National Service. Sir L. Worthington-Evans stated last week that pensions had been granted to nearly 600,000 disabled men and to over 12,000 disabled officers; about 20,000 new awards were being made each week to men as they were demobilized, and more claims

were to be expected from men now in hospital. At the time of the armistice there were 550,000 men in hospital at home and abroad; this number had been reduced to about 200,000, many admitted for merely temporary ailments. Many, however, would become pensioners, and he estimated that there would be at least 700,000 temporary pensioners; of these an unknown number would become entitled to permanent pensions. The Ministry had arranged to take over the orthopaedic hospitals from the army and to establish out-patient clinics in surrounding towns and districts, under the direction of the surgeons attached to these hospitals; similarly, treatment would be provided in hospitals and out-patient clinics for cases of nervous disease. It was hoped in this way to make a resurvey of cases which would benefit from treatment by orthopaedic and nerve specialists and to give a further chance of treatment to those who had, for one reason or another, discontinued it. The nature of the problem was realized fully by his chief medical adviser and his assistants, and adequate arrangements were being made. It was estimated that the classes falling within the terms of the Pensions Warrant with regard to training numbered about 350,000 men; not all desired to receive or were qualified to receive training, but there would be, it was expected, a large number for whom training ought to be provided. The men who had lost a limb numbered 24,000, and those who had received some injury either to a leg or an arm not necessitating amputation 128,000; it was probable that a large number of these would not be able to carry on the same manual labour as before. The neurasthenics numbered 36,000, and many of them would require outdoor employment, as would also many of the 60,000 sufferers from chest complaints, including tuberculosis. The number of cases of rheumatism was 39,000; some had been cured, but others would require to find indoor work. Of the 54,000 men suffering from heart trouble many might have to change their previous occupation if it involved heavy physical strain. Many of the 10,000 men suffering from deafness would be unfit to go back to their previous employment. At St. Dunstan's and at Newington House, Edinburgh, 1,435 blind men had received training. Of the 350,000 men some had been cured, but a large number were still under treatment and not yet ready for training; many were capable of resuming their previous occupation, but many more had been attracted by high wages to occupations which might prove to be temporary. At present the Ministry of Pensions had trained, or had in training, 24,000 men. Arrangements had been made through local war pensions committees, which had 600 schemes, and instruction had been given at technical institutions, agricultural colleges, farms, and market gardens. In all the main industries trade advisory committees had been formed to advise the local committees, but new schemes and a great extension of the training facilities were required. It had been decided by the Cabinet that industrial training should be placed under the Ministry of Labour, and in future the Ministry of Pensions would confine itself to training during the time that a disabled man still required medical care and attention. For this purpose it would take over gradually many of the army hospitals, and in some a start had already been made in giving the men preliminary training while in hospital. It was proposed to set up six or eight convalescent centres into which men could be drafted from hospital; in each centre, which would be under the charge of medical men, small training shops covering a variety of trades would be set up, where the disabled man could make a choice of the class of training he might desire ultimately to undertake. The centres would be opened gradually as experience showed the need for them; a start was being made by the Hayes Filling Factory in Middlesex, which it was hoped would be in full working order within a few months.

SIR WILLIAM CROOKES.

Sir William Crookes, who died on April 4th in his 87th year, early won high distinction as a chemist, but it was chiefly in the borderland of chemistry and physics that his great work was done; it was, indeed, through the spectroscope, then a new instrument of research, that he was led in 1861 to the discovery of a new element, thallium. In the course of determining the atomic weight of this new metal he undertook experiments which aroused his interest in certain phenomena to be observed in a vacuum, and so in the study of the phosphorescent glow produced in a high vacuum tube when the current from an induction coil was passed through it. Crookes suggested that the facts might be accounted for on the hypothesis that from the cathode were expelled streams of particles which, travelling in straight lines at great speed, bombarded the glass side of the tube and so produced the phosphorescence. The glow could be made to change its position by a magnet, and Crookes explained this by the further hypothesis that the particles carried a charge of negative electricity. Through the work of Sir J. J. Thomson and Dr. Johnstone Stoney this hypothesis grew into the electronic theory of matter which has so profoundly influenced the thoughts of physicists in this generation. Lennard showed that certain rays could pass out of the tube through a thin plate of aluminium, and in 1895 Roentgen, a Swiss trained physicist working in Bavaria, made the accidental observation that rays passing out of the tube affected a covered photographic plate. The whole story is a good example of the way in which a scientific inquiry which may seem to have no possible relation either with practical affairs, or broad and fertile theory, may develop in both directions. Crookes's troubles in weighing thallium led by a side path to the contrivance he named the radiometer, which most people have seen. It consists of a set of light discs, black on one side and polished on the other, suspended on a vertical axis in a partial vacuum; the vanes are in almost constant motion owing, as was once thought, to the pressure of light, but now explained as due to stresses. To this succeeded the vacuum glow tube, and to that the *x*-ray tube which is to-day a common implement of diagnosis in medicine and surgery. In 1909 Sir William Crookes undertook experiments for the Glass Workers Cataract Committee of the Royal Society, with a view to preparing special glasses for the use of furnace workers. He succeeded in preparing suitable glasses by the incorporation of various metals; among these cerium gave a colourless glass with a high power of absorbing ultra-violet rays. To obviate the effects of glare it was, however, found desirable that the glass should be tinted, and glasses of pale green, yellow, and neutral tint were prepared, so that a choice of tints was available to suit individual requirements. For some reason or other full commercial use has not yet been made of this invention, but possibly with the cessation of the war more will be done to render the goggles made from glass of this kind less costly. Another matter related to medicine in which Sir William Crookes took an interest was the use of colloidal remedies in medicine. Much of the work was carried on by his son, the late Mr. Henry Crookes, under the general direction of his father. Crookes was also the first to inform the public of the possibility of obtaining nitrogen for manurial purposes from the air. The method has been largely used in Germany during the war for the production of explosive substances also. Sir William Crookes was the founder in 1859 of the *Chemical News*, and continued to own and edit it to his death.

RED CROSS AMBULANCES FOR HOME USE.

The Joint War Committee of the British Red Cross Society and the Order of St. John expects shortly to receive from abroad 500 of its motor ambulances in good running order, and has devised a scheme for their use in

civil life. The scheme has been worked out by a Home Service Ambulance Committee, and a letter has been addressed to the county directors asking them to organize the work in each county. It is intended to satisfy the needs of rural districts before considering applications from great towns. The county directors will decide in what towns or villages in their area ambulances should be stationed, the idea being that they should not be, as a rule, more than thirty miles apart. The ambulances will not be attached to hospitals, as it is intended that they should be freely available for the removal of sick or injured persons to the institutions most suitable for their treatment. The ambulance will be kept in a local garage, the managers of which will be responsible for keeping it in going order, under the control of the county director, who, it is suggested, should set up a small committee to assist him in local supervision. It is suggested that a charge should be made for the use of an ambulance, and although this must vary in different counties, a fee of 1s. 3d. a mile is suggested, the county director (or the county committee working with him) having power to remit the charge in cases of emergency, or when the circumstances of the patient make it desirable. The ambulances are fitted with the standard War Office type body, and are capable of taking four stretcher cases or eight sitting cases. Applications, which should be addressed to Mr. F. C. Davies, 83, Pall Mall, London, S.W.1, will be dealt with in the order of receipt. They will be satisfied as far as possible, but this will depend on the rate at which the ambulance cars arrive from overseas. The present scheme is to be in force for twelve months, during which it is expected that much valuable practical information will be acquired by the committee. From communications we have received from medical practitioners in rural districts since the scheme was mooted we have no doubt that its meets a real want, and we have confidence that through the existing organizations of the British Red Cross Society and the Order of St. John any difficulties which may arise in finding drivers will be overcome. We would advise doctors in rural districts to get into communication with the county director, and we shall be glad to receive any general suggestions on matters of principle.

AMONG the special honours announced on April 7th, the day on which the Grand Fleet was dispersed and the flag of the Commander-in-Chief hauled down, was the K.C.M.G. conferred on Surgeon Captain R. Hill, R.N., C.B., C.V.O., Principal Medical Officer of the Fleet through the years of its watch and ward in the North Sea.

Medical Notes in Parliament.

Dogs' Protection Bill.

THE Dogs' Protection Bill, which was introduced by Sir Frederick Banbury, came up in the House of Commons on April 4th as amended by Standing Committee on the previous day. The first clause read:

Notwithstanding anything in the Cruelty to Animals Act 1876 (hereinafter referred to as "the principal Act"), it shall be unlawful to perform any experiment of a nature calculated to give pain or disease to any dog for any purpose whatsoever, either with or without anaesthetics, and no person or place shall be licensed for the purpose of performing any such experiments.

Sir Hamar Greenwood (Under Secretary for the Home Office) moved to insert after the word "unlawful" the words "except as hereinafter provided." He explained that this was a drafting amendment to bring the bill into line with the governing Act, the Cruelty to Animals Act, which governed the whole question of experiments on animals.

Sir Frederick Banbury raised a point of order as to whether Sir Hamar Greenwood contemplated submitting sequentially on this amendment amendments which had been ruled out of order in Committee upstairs. The Deputy Speaker said that the ruling of the Committee would govern the proceedings in the House.

Sir Hamar Greenwood then read the amendment which he proposed to move after the preliminary amendment. He would propose that, after the word "anaesthetics" in the clause, the remainder of the clause should be left out, and the following words inserted instead:

except on such certificate being given as is mentioned in the principal Act, stating in addition to the statements required by section 3 of that Act, that for reasons specified the object of the experiments would necessarily be frustrated unless it is performed on a dog and that no other animal is available for such experiments.

Sir Frederick Banbury submitted that that amendment would be out of order as going beyond the scope of the title of the bill. It was, he said, the same amendment as was moved in Committee and, after very careful consideration, ruled out of order by the Chairman. The title of the bill was "A Bill to prevent the Vivisection of Dogs." It was not a bill to alter the present law by substituting a different form of certificate from the form of certificate required now. In Committee the Government realized this, and proposed to put down amendments to alter the title. They proposed to leave out the word "prevention" and to insert the words "impose further restrictions on," so that the title would read "A Bill to impose further restrictions on the Vivisection of Dogs." Lieut.-Colonel Guinness urged that prevention did not necessarily mean complete prevention. According to the precedent which applied in such cases, prevention must be read as limited prevention, and therefore he submitted that so long as this Act provided in any shape or form for prevention, it would still be within the scope of the short title. The Deputy Speaker said he had had an opportunity of considering the amendment put forward by Lieut.-Colonel Guinness, and his ruling was that it came within the scope of the bill, and that accordingly it was in order.

The preliminary amendment having been carried, Sir Hamar Greenwood moved the sequential amendment as above.

Sir F. Banbury said he could not accept the amendment. In his opinion the Home Office did not take sufficient care in certificates. At the present moment any one could experiment on a dog if he obtained a licence from the Home Office and two certificates afterwards. All that was now proposed was to add another licence or certificate.

Sir Hamar Greenwood, interposing, said that Sir F. Banbury ought to be accurate; there was a licence and a certificate, and a subsequent certificate and a third. At this point the debate was automatically adjourned, it being 5 o'clock.

Sir Frederick Banbury has put down the bill for further consideration on a Friday in May when the Labour Party's Industrial Trades Bill is the first order. Sir Frederick's bill is the second order.

Ministry of Health: Scotland.

SCOTTISH BOARD OF HEALTH BILL THROUGH STANDING COMMITTEE.

The Scottish Board of Health Bill has passed the Standing Committee on Scottish Bills over which Mr. Rendall presided.

Proposal for a Separate Ministry Rejected.

Mr. Wm. Graham (Lab., Edinburgh Central) moved an amendment to establish a separate Ministry of Health for Scotland. The Scottish Office was grossly overloaded and there must be some decentralization.

Dr. Murray (Ind., Western Isles) said it was feared in Scotland that the bill might merely result in a change of name. England had found it necessary to have a separate Minister. Scotland, which had always been in the forefront of social legislation, should not lag behind in this. Scotland had a separate system of law, and he trusted the representatives of the law would apply to medical matters the same principle they applied to legal.

Mr. Mackinder (Glasgow, Camlachie) said that specialization in the minister who controlled the administration of health in Scotland was needed. There should be two under secretaries, one of whom ought to be in Edinburgh, and be concerned only with health. It was the best way by which 400 miles between London and Scotland should be annihilated.

Mr. J. Johnstone (Renfrewshire, E.) spoke in a similar strain. Mr. C. B. Murray (Edinburgh, W.) said that the demand for a separate minister in Scotland had been widespread, but lately there had been a great change in public opinion. The power to the Secretary for Scotland to appoint an under secretary should be mandatory, and the under secretary should be for health administration only.

Mr. Munro repudiated the suggestion that Scotland was behind England in administration, but it was necessary to ask whether it was there and then desirable to have a separate Minister. When Scottish Home Rule was an accomplished fact there would be separate ministers for all the Government services in Scotland. But with an imperial Parliament and the Secretary for Scotland spending most of his time in London, was it discreet to remove from his jurisdiction altogether all health matters? Scotland might be sure that it would not get two ministers in the Cabinet, and in Cabinet discussions the Minister of Health would have to get the Secretary for Scotland to act for him. He would not like to be in the position of a gramophone reproducing his master's voice. It was not the best foundation on which to build a strong structure. He could not accept this amendment.

Sir H. Dalziel objected that at present any minister who was not in the Cabinet but whose department was affected by any matter was called before the Cabinet and allowed to state his case before a decision was reached. The amendment was a step towards Home Rule.

On a division the amendment was lost by 28 votes to 12.

Proposed Suppression of Medical Research.

A motion to prevent "vivisection" in research was opposed by the Secretary for Scotland and lost.

Parliamentary Under Secretary for Health.

The Secretary for Scotland was "reluctantly" compelled to accept an amendment making definitive the appointment of a parliamentary under secretary "for health." Thus there will be a new Scottish parliamentary under secretary specifically for health.

Representation of Labour.

A determined effort was made by the Labour members to secure the appointment of a representative of Labour on the Board.

Mr. Munro reminded them that the Board was an amalgamation of two existing boards, and that the members would be civil servants who would represent no interest but public health. While he could not accept this amendment, he promised that when it came to the appointment of the consultative committees to make it clear that on these Labour should have a voice. The amendment was defeated by 24 votes to 13.

Medical Inspection of School Children.

An amendment seeking to transfer the medical inspection of school children to the Board forthwith was put forward by Sir J. Hope, who reminded the Committee that a universal demand had compelled this to be done in the English bill.

Mr. Munro thought it premature, as these powers were only recently conferred by the Education Act on the local education authorities in Scotland. Such transfer would only affect the central authorities, not the local authorities. It would be a retrograde step to take this matter out of the hands of the county education authority and hand it over to a district committee or isolated burgh.

Mr. Munro accepted an amendment, moved by Sir John Hope, to provide that from time to time, by an Order in Council, enactments relating to lunacy and mental deficiency might be transferred to the Health Ministry.

The bill passed through Committee.

Ministry of Health Bill (England, Wales, and Ireland).

THROUGH THE COMMONS.

The Ministry of Health Bill was considered on report, and read a third time in the Commons on April 9th.

The only important amendment on report was one submitted by Dr. Addison consequent on the decision in Standing Committee for the transfer, from the Education Board to the Health Ministry, of the powers for the medical inspection of children. It will be recalled that Dr. Addison objected to the immediate transfer, saying that there were practical difficulties to this addition to the work of the Ministry at first. He now proposed that this transfer should be qualified as under:

Provided that, for the purpose of facilitating the effective exercise and performance of these powers and duties, the Minister may make arrangements with the Board of Education respecting the submission and approval of schemes of local education authorities and the payment of grants to local education authorities, so far as such schemes and payment relate to, or are in respect of, medical inspection and treatment; and the powers and duties of the Minister may under any such arrangements be exercised and performed by the Board on his behalf and with his authority under such conditions as he may think fit.

The amendment was adopted.

MEETING OF THE PROFESSION IN EDINBURGH AND LEITH.

At a largely attended meeting of the medical profession in Edinburgh and Leith, attended both by members of the British Medical Association and non-members, to consider the Scottish Board of Health Bill, the following resolutions were unanimously adopted:

That even if it involves an addition to the membership of the Board, there should be two members representing the clinical side of medicine.

Having now considered the bill of the Scottish Board of Health, this meeting is strengthened in their conviction of the necessity for the establishment of a standing medical consultative council, the members of which should be elected directly by the profession, and should have powers to discuss and make representations to the Board on any matters which in their opinion affects directly or indirectly the health of the community, and this council should have power to meet jointly with any council, medical or lay, as occasion arises. This council should consist of at least eleven members, one of whom should be a registered dentist with a medical qualification.

Tuberculous Soldiers.—In a written reply to Sir Watson Cheyne, Major Astor stated, on April 3rd, that the number of men discharged from the army since August 4th, 1914, on account of pulmonary tuberculosis could not be precisely determined from the records of the Pensions Ministry, but it was estimated at 25,000. He was unable to say how many of these were considered suitable for institutional treatment or did actually undergo such treatment. The number undergoing residential treatment in sanatoriums and hospitals on March 1st, 1919, was approximately 3,150, and the number on the waiting list was 470.

Women Doctors and Nurses in Military Employment.—In the second reading debate on April 4th on the Women's Emancipation Bill, introduced by Mr. Adamson (the Labour leader) to remove disabilities still imposed upon women, Captain Elliot made a contribution which attracted attention for its freshness, originality and vigour. The bill proposes that no woman shall be disqualified by sex from civil or judicial office. Captain Elliot, in the course of his speech, regretted that the measure did not deal also with the disqualification of women from holding military rank. His opinion was that women doctors and nurses serving in the army should be allowed commissions. The bill was read a second time.

Medical Treatment of School Children in Ireland.—The Attorney-General for Ireland stated on April 7th that the vote for the medical inspection of national school children and the services auxiliary thereto in Ireland was first made in 1912. The amount was £7,500, and in 1912–13 the expenditure £263. In 1913–14 £5,000 was provided and £498 expended; in 1915–16 £2,000 was provided and £548 expended; in 1917–18 £1,030 was provided and £647 expended. In 1918–19 the provision was £1,500 and the expenditure £498.

The Demobilization of Army Medical Officers.—Mr. Churchill stated, in reply to Lieut.-Colonel Weigall, on April 8th, that the total numbers of medical officers released from the army during the months of January, February, and March were 403, 1,071, and 1,787 respectively.

Scotland.

HONORARY DEGREES AT EDINBURGH.

THE University of Edinburgh intends to confer the honorary degree of LL.D. upon Emeritus Professor Sir Thomas Fraser, F.R.S., of Edinburgh, Major-General Sir W. G. Macpherson, K.C.M.G., A.M.S., Professor Rutherford Morison, F.R.C.S., of Newcastle, Professor D. Noël Paton, F.R.S., of Glasgow, and Brigadier-General A. E. Ross, C.B., Director Canadian Army Medical Service, France. It will confer the same degree on Mr. Wilson, President of the United States, on Cardinal Mercier, Archbishop of Malines, and on Admiral Sir David Beatty and Field Marshal Sir Douglas Haig.

SIR THOMAS R. FRASER.

Sir Thomas R. Fraser, Emeritus Professor of Materia Medica in the University of Edinburgh, in addition to the Honorary LL.D. from his Alma Mater, is to be honoured by having his portrait presented to him by the colleagues and students who during the forty-one years of his occupancy of the chair have acknowledged the inspiration of

his teaching. In a letter signed by Sir J. Alfred Ewing, the Principal of the University, by Sir Robert W. Philip, the President of the Royal College of Physicians, and Dr. McKenzie Johnston, the President of the Royal College of Surgeons, the intention of making the presentation has been brought before many of Sir Thomas's former students and already a number of subscriptions have been intimated. Since others, however, may wish to join in this expression of regard, Professor Harvey Littlejohn has agreed to act as honorary treasurer, and to him contributions may be addressed at 11, Rutland Street, Edinburgh.

Correspondence.

THE NAVAL MEDICAL SERVICE.

SIR,—In the JOURNAL of April 5th Acting Surgeon Commander W. K. Wills, R.N.V.R., makes the following statement in a letter entitled "The Naval Medical Service": "During the influenza period an Admiralty weekly order arrived stating that an anti-influenzal vaccine had been prepared, and would be available shortly, and directing that medical officers of ships should ask for volunteers for the prophylactic treatment. *No details were forwarded to principal medical officers of ships from the medical director-general's office, nor from the laboratory as to the composition of this vaccine, nor of the anticipated after-effects.*"

I am desired by the Medical Director-General to say that the latter part of this statement (here in italics) is incorrect. Full details as to the composition of the prophylactic influenza vaccine, and directions for its use, accompanied every bottle of the vaccine issued to medical officers of ships and of the Royal Navy in general. These instructions as to the composition, etc., of the vaccine (copy enclosed) are based on the recommendations of a conference held at the War Office on October 14th, 1918 (JOURNAL, October 26th, 1918, p. 470).—I am, etc.,

W. L. MARTIN,
Surgeon Commander, R.N.,
Assistant to Medical Director-General.

London, W., April 7th.

Instructions Issued with All Supplies of Navy Prophylactic Influenza Vaccine.

The following is the composition of the Naval prophylactic vaccine which is being supplied to ships and dépôts as required, together with the instructions given for its use.

	First dose.	Second dose.
B. influenzae (3-5 strains)	... 30 millions	... 60 millions.
Streptococcus pyogenes (3-5 strains)	40 ,,	... 80 ,,
Pneumococci (3 strains)...	... 100 ,,	... 200 ,,

The dosage was settled at a meeting of bacteriologists called by the Medical Director-General of the Army at the War Office, and under the presidency of Sir W. L. Leishman, K.C.M.G., C.B. In the case of persons under 16 years of age, half the above dose should be given.

The vaccine was to be polyvalent for each organism, and these were to be standardized by Dr. Douglas at St. Mary's Hospital before being passed on to the R.N. College, Greenwich, and the R.A.M. College, Millbank, when the vaccine is to be made in bulk.

The vaccine, if given as directed, is not likely to give rise to anything but slight inconvenience, and it is believed that it will give possible protection from influenza and most certainly will diminish the danger of the secondary dangerous sequelae.

Full records should be kept of results, and all demands must be forwarded to Greenwich stating the number of men for whom vaccine is required, which should always be called "N.P.I.V." (Naval Prophylactic Influenza *Vaccine*, not serum).

Directions for Use.

Dosage.—Persons over 16 years of age: First dose, 0.5 c.cm.; second dose, 1.0 c.cm. For children 16 years and under half the above dose should be given. Interval between doses, eight to ten days.

Period of twenty-four hours' light duty should be given after inoculations. Administration of vaccine should not be carried out in those suffering from pyrexia or acute catarrhal symptoms from any cause.

It is requested that statistics be kept dealing with the following points:

1. Reactions following inoculations.
2. Incidence of disease amongst those inoculated and those uninoculated.
3. If influenza occurs in those inoculated, whether it started after the first or second inoculation.
4. Severity of disease in those inoculated compared with those uninoculated.

(Sgd.) W. H. NORMAN,
Medical Director-General.

November 2nd, 1918.

NURSES' REGISTRATION BILLS.

SIR,—I trust that you will allow me, as honorary medical secretary of the Central Committee for the State Registration of Nurses, to offer a few observations upon the annotation headed "Nurses' Registration Bills" that appears in your issue of April 5th. In the first place, the scope of the Central Committee's bill is not limited merely to State registration, as is stated in the college memorandum quoted in the annotation. The bill deals with the whole subject of the control and standardization of the education of nurses, and in such a manner and to such an extent as will, in the opinion of those well qualified to judge, lead to a great improvement in the economic position of nurses generally.

Secondly, the financial basis of the Central Committee's bill is not inadequate. The number of trained nurses who are already upon the registers of the large nurses' societies which are supporting the Central Committee's bill (the Royal British Nurses' Association and others) leads the promoters of that bill to anticipate with confidence that the number of nurses who will register during the period of grace (two years) will be amply large enough to provide by their registration fees for the financial security of the Central Committee's scheme.

At a modest computation this number would be 50,000 for the first two years. After that period a sufficient yearly fund would be furnished by the examination and registration fees of new nurses. But the fees need not be high. The college has already appealed to the charitable for funds to carry out its scheme, and will doubtless continue to do so. But nurses as a body are averse from being dependent upon charity for what they can pay for themselves; and if it should come to pass that the fees paid by the nurses are not sufficient (an event the Central Committee does not for a moment anticipate), then the nurses would rather appeal to the State for a grant than to the charitable for alms.

Thirdly, one of the chief objects of the college bill is to establish the college by Act of Parliament. The Central Committee is of the opinion that while this aim may be quite praiseworthy, it ought not to be accomplished in and by an Act. They fear that by this incorporation of the college, or of any association of private persons, the General Nursing Council which the Act will set up will not be the independent body the nurses desire and should have.

In the fourth place, the difficulties of reconciling the two bills have not been due to conflict of personality but to differences on important questions of principle.

Lastly, I would point out that delegates of the British Medical Association have taken an active part in drafting the Central Committee's bill; and at a meeting of the Central Committee held a few months ago supported the resolution which the committee then passed, after a careful consideration of both bills, that the bill of the Central Committee was the better of the two.—I am, etc.,

E. W. GOODALL,
Honorary Medical Secretary, Central Committee for the State Registration of Nurses.

Grove Military Hospital, April 7th.

THE MEDICAL PARLIAMENTARY COMMITTEE'S CONFERENCE.

SIR,—The Medical Parliamentary Committee appointed in October last, on the motion of Dr. Addison, to ensure that the considered views of the medical profession should be voiced by representative medical men in the House of Commons, has arranged to hold a conference to discuss the best method of constituting a permanent Medical Parliamentary Committee. The conference, to which all bodies or associations interested in health questions are being invited to send representatives, will be held under the chairmanship of Sir W. Watson Cheyne, Bt., M.P., at the Central Hall, Westminster, on Friday, May 2nd, at 3 p.m. If any medical organization with the objects indicated has not received a formal invitation, we shall be obliged if its secretary will communicate with us.—We are, etc.,

ARTHUR LATHAM,
CHAS. BUTTAR,
Honorary Secretaries of the Medical Parliamentary Committee.

20, Hanover Square, W., April 7th.

Obituary.

SIR JAMES MACKENZIE DAVIDSON, M.B., C.M.ABERD.,

Consulting Surgeon X-ray Department, Moorfields Eye Hospital, and Charing Cross Hospital.

THE death, on April 2nd, from heart failure, of Sir James Mackenzie Davidson in his 62nd year, will cause very great regret to all who knew him, and deprives the department of medicine to which he had devoted himself for over twenty years of one of its pioneers. He published in the *Archives of the Roentgen Ray*, as early as July, 1897, a radiograph of a bladder stone, and hinted at the importance of the *x*-ray diagnosis of kidney stones. From that date onwards he was a frequent contributor to both medical and scientific journals of papers, all of which indicated distinct advances in both method and diagnosis. One of his last publications was a book entitled *Localisation by X Rays and Stereoscopy*, a subject on which he was an authority.

James Mackenzie Davidson's father had settled at Estancia Santo Domingo, Buenos Aires, and the son was born there and received his early education at the Scottish School, Buenos Aires. He studied medicine in Edinburgh, London, and Aberdeen, and graduated M.B., C.M. at the University of Aberdeen in 1882; that same year he started, along with another young doctor, an eye clinic in the east end of the city. He became assistant to the professor of surgery, Sir Alexander Ogston, and in the class of practical surgery gained experience in teaching which served him well in later years in his own special branch. In 1886, on the death of Professor Dyce Davidson, he succeeded him as ophthalmic surgeon to the Aberdeen Royal Infirmary, and filled this office till 1895. He was also ophthalmic surgeon to the Royal Hospital for Sick Children, and on his resignation from the infirmary staff in 1895 he amplified and elaborated the Eye Institute, and had it moved from the Dispensary Buildings to new quarters in King Street, where it still exists.

All this time Mackenzie Davidson was lecturer in ophthalmology in the University of Aberdeen, and continued to attract large numbers of students to his class and to his out-patients. He was a born teacher, and took a keen personal interest in all his students, while his relations with the rest of the profession were always most cordial. Not a few of his pupils have since distinguished themselves in ophthalmic work. With his patients he was very popular, being kind and courteous to a degree, and very often unostentatiously gave help to needy cases. He possessed an even temper, was deliberate in all his movements, and took infinite pains with his work, while his training under Ogston made him early take up the antiseptic methods and adapt and apply them to his eye work. He was careful, painstaking, and orthodox in his operating, and achieved renown far and wide, his practice being a large and increasing one.

Mackenzie Davidson had a natural bent towards physics, and spent much of his spare time while in Aberdeen carrying out physical experiments and designing apparatus, mostly in connexion with light and electricity, while he gave freely towards the education of the public by popular lectures, which were lavishly illustrated by costly experiments, and were always deeply appreciated by large audiences.

Immediately on the publication of Roentgen's paper early in 1896 Davidson, by one of those flashes of genius which occur sometimes to light the path to great eminence, intuitively recognized the importance of the discovery and its possibilities medically and surgically. With some difficulty he obtained a 10-inch coil and two Crookes's tubes, with which he immediately began to experiment, so that he was probably the first in Scotland to produce photographs by the new rays. He continued his trials and experiments in Aberdeen till 1897, when he removed to London. Aberdeen was very sorry to part with him, but it was realized at the time that he was destined to take a very high and important place in the then infant science of radiography, and there is no doubt that it is a fortunate thing for British radiography that he took up the subject when he did, and left Aberdeen for London, where he has continued to advance the science ever since. His contributions to the subject have been such that Aberdeen City and Aberdeen University are justifiably proud of having had him as a citizen and as an alumnus.

He had great inventive skill, and to the end of his life was interested in improving old, and in devising new, *x*-ray apparatus. In 1900 he described at the Röntgen Society a new rotary mercury break, afterwards known as the Mackenzie Davidson break, which came into almost universal use. At the same meeting he described for the first time a stereoscopic fluoroscope, and drew attention to the future possibilities of this as a method of examination. As early as February, 1898, he described to the Röntgen Society his "cross thread localizer." This was the first instrument which allowed of the exact localization of foreign bodies, and it laid down the principles of the triangulation method, on which nearly all the later methods are based. As applied to eye work the accuracy of localization is little short of marvellous, and Davidson's work on this subject has resulted in the saving of sight in innumerable cases. Perhaps that part of *x*-ray work which interested him the most was the stereoscopic method, and so great was his belief in its advantages, that almost all his examinations were made by means of stereoscopic plates. In the very early days he designed an *x*-ray couch, especially for use with the thread localizer, and one, the last of his inventions, was another localizing table, in which the tube underneath worked synchronously with the screen above; this table was designed especially for war work. Apart from *x*-ray work, he was one of the earliest workers with radium, and it was he who first pointed out that certain forms of *x*-ray dermatitis were benefited by radium treatment.

The telephone probe for the localization of metallic foreign bodies was another instrument which attracted his attention. He had devised an improved appliance while still in Aberdeen, and tested it in the Royal Infirmary there. Afterwards he still further perfected it, and, like his localization method, it was used both in the South African war and during the European war of 1914–18. In 1916 he became honorary consulting radiologist to the military hospitals of the London districts, although he did not receive a commission. He took to this work with his habitual keenness, and in his rounds of the *x*-ray departments scrutinized every detail, advising, encouraging, and instructing.

Mackenzie Davidson was consulting surgeon to the *x*-ray department of the Royal London Ophthalmic Hospital, Moorfields, and of Charing Cross Hospital; he was president of the Röntgen Society of London in 1912–13, and of the Radiology Section of the International Congress of Medicine in London in 1913. He was also an honorary member of the American Roentgen Ray Society. The *x* rays took physical toll of him, and after suffering for some years from *x*-ray dermatitis he had to submit his right hand to more than one operation; but he never lost heart, and continued the same eager ingenious investigator and inventor that he had always been.

He married in 1886 the daughter of Mr. William Henderson of Aberdeen, and to Lady Davidson, to his son and daughter, we venture to extend the sympathy of the medical profession.

Dr. Thurstan Holland, one of his successors in the chair of the Röntgen Society, writes: "Apart from his valuable and original work he will be missed by all of us interested in radiology. To my mind one of his outstanding characteristics was his keenness, and his interest never faltered right up to the end. Further, he was a man who always welcomed any one interested in *x*-ray work, and he was always ready and willing to show his methods and demonstrate his instruments, etc., to fellow workers. He is a very great loss to British radiology."

WILLIAM ALLEN STURGE, M.V.O., M.D.LOND., F.R.C.P.

IN Dr. Allen Sturge, who passed away on March 27th after several years of cardiac instability and poor health, we have lost an accomplished physician and a distinguished archaeologist.

He came of a fine Quaker stock on both sides. He was born at Bristol in 1850, and began his professional studies at the Bristol Medical School, and continued them at University College Hospital, London, where he soon made his mark and gained the warm regard of his teachers and of his fellow students. He was a close and accurate observer, keen in reasoning and original in speculation.

After holding the post of physician's assistant he became a resident officer and subsequently registrar at the National

Hospital for Paralysis and Epilepsy. There he laid the foundations of a wide and thoughtful survey of nervous diseases. Having taken his M.D. at the University of London, he followed up his studies in nervous diseases by a lengthened stay in Paris in 1876. That was a time when Charcot, like a magnet, was attracting neurologists young and old to his clinic at the Salpêtrière. But Sturge did not limit his studies to neurology; he worked at general pathology and medicine, and followed closely Fournier's practice at the St. Louis. Both Charcot and Fournier bore generous testimony in after years to Sturge's critical acumen and originality.

When in 1877 he returned to London he was appointed physician and pathologist to the Royal Free Hospital, and one of the lecturers to the Women's Medical School. His strong liberal sentiments made him an early and warm supporter of women's medical education. He was married to a talented lady doctor—Miss Emily Bovell—and they started in practice in Wimpole Street. There seemed a distinguished career opening for Sturge as a neurologist, a general physician, and a clinical teacher. He had the gift of fluent and luminous exposition, and was eagerly listened to, not only by his students, but by the members of the London medical societies. Unfortunately there only remain four of his medical papers available. Of these, in every way the most important and characteristic is one in the fifth volume of the *Proceedings* of the Medical Society of London, p. 357, on the study of muscular atrophy as an aid to the physiological investigation of the spinal cord. In this paper there are some original clinical observations of considerable interest, but there are also very lucid and discriminating statements on the physiological grouping of muscular atrophies and their diagnostic importance which are valuable still as sound and helpful generalizations.

His three papers in the twelfth and fourteenth volumes of the Clinical Society's *Transactions*, on a case of erythromelalgia, on a case of spondylitis, and on nerve stretching are good examples of Sturge's gift of not only narrating the salient features of any case, but of setting forth its general bearing. Sturge was exceedingly humane. From his studentship onwards he took the deepest interest in the welfare of his patients. He never spared his efforts, especially for poor chronic nervous cases, to make the best of their condition, and he was so well read and wide in his intellectual sympathies that it was no wonder that many educated men and women found in him a tower of strength, especially in conditions of overstrain. But in 1880 his wife's health began seriously to flag, and he came to the conclusion that for her sake he ought to seek a milder climate. He determined to settle in Nice, and he made it his home for twenty-seven years during the late autumn, winter, and spring months. By degrees he gained one of the best professional positions on the Riviera, and he secured the esteem of his English and French brethren and of the municipal authorities as well as the confidence of residents and visitors. The success of Queen Victoria's four spring holidays at Cimiez was in no slight degree due to the care and forethought which Sturge gave to securing the safety and the amenities of her residence. He had a bad attack of rheumatic fever in 1894 and another in 1899. In 1907 he determined to relinquish practice and return to England.

He had given considerable attention in his holidays to early Greek art, and had acquired a valuable collection of Etruscan vases; but for some years his summer leisure had been largely devoted to prehistoric archaeology. He gradually collected large and important groups of palaeolithic implements, and when he settled in England he chose his home at Icklingham Hall, Suffolk, in the very centre of this special field of archaeological research. He was enabled during the twelve years of his residence there to create the finest private museum in the world of flint implements, because his untiring local investigations and findings supplemented the very varied and extensive collections which he had previously acquired. His aim was always to make a minute study not only of the human chippings but of glacial and other markings on his flints—and of their patination, and he made the most careful note of their provenance. His study of detail was combined with much reflection and investigation of cognate problems as to antiquity and altered physical conditions.

Sturge stimulated his fellow-workers by ungrudging advice and demonstrations. He was one of the founders and the first president of the Society of Prehistoric Archaeology of East Anglia, to the *Transactions* of which he contributed several papers, and with rare generosity he bequeathed his splendid educational collection of more than 100,000 pieces to the nation.

Sturge married for his second wife, in 1886, the daughter of Mr. A. C. Sherriff, M.P. for Worcester. She was his devoted fellow-worker in his archaeological and many other activities, and she survives him. He left no children to carry on his name, but he will live in the memory of his friends as an inspiring personality and a generous soul, and his wide outlook and passionate love of knowledge will never be forgotten. THOMAS BARLOW.

EDWARD LIVEING, M.D.CANTAB., F.R.C.P.,
Emeritus Registrar, Royal College of Physicians.

BY the death of Dr. Edward Liveing, which occurred on April 2nd in his 88th year, the medical profession loses one of its oldest members. He was born at Nayland in Suffolk in 1832, the second son of Mr. Edward Liveing, a medical practitioner who had long been settled in that district. After obtaining his preliminary education at King's College, London, he began to study medicine at King's College Hospital, and obtained the diploma of M.R.C.S. in 1854. After this he entered at Caius College, and in 1858 graduated in the mathematical tripos, obtaining the thirtieth place among the senior optimes. In the following year Dr. Liveing took the degree of M.B., and passed the newly instituted examination for the membership of the Royal College of Physicians of London. In 1870 he graduated M.D.Cambridge, and in 1874 was elected a Fellow of the College. He was, besides, a Fellow of King's College, for a time assistant physician to King's College Hospital, and examiner in medicine at Cambridge in 1870–71.

In 1886 Dr. Liveing was appointed Assistant Registrar of the College of Physicians, and, on the resignation of Sir Henry Pitman in 1889, Registrar. This important post he held for twenty years, and throughout the whole time he conducted the work of his department with ability and invariable courtesy, which earned him the respect of all with whom he came in contact. On his retirement from the post in 1909, the honorary distinction of Emeritus Registrar was conferred upon him. Dr. Liveing's only publication was *On Megrim: a Contribution to the Study of Nerve Storms*, a book which was much esteemed in its day. His younger brother, Dr. Robert Liveing, died a few weeks ago, well over 80, and his eldest brother, Professor G. D. Liveing of Cambridge, still survives, having attained the age of 92, a remarkable record of longevity in a family.

The Services.

HONOURS.

THE King has conferred the honour of K.C.M.G. upon Surgeon Captain Robert Hill, R.N., C.B., C.V.O., P.M.O. of the Grand Fleet, in recognition of services rendered during the war.

The following appointments to the Most Excellent Order of the British Empire (Military Division) are announced:

To be Knight Commander.

Surgeon Rear Admiral George Robertson Turner, C.B., for valuable services as Consultant Surgeon, Royal Naval Hospital, Plymouth.

To be Commanders.

Surgeon Commander Charles Kendal Bushe, R.N., for valuable services as Officer in Charge of His Majesty's W./T. Station, Bathurst, Gambia.

Honorary Surgeon Lieutenant J. Donald Pollock, R.N.V.R., for valuable services at H.M. Naval Base, Granton.

Surgeon Lieutenant Evelyn Dennis Scott, R.N., for valuable services at Queen Mary's R.N. Auxiliary Hospital, Southend-on-Sea.

ARMY OF OCCUPATION BONUS.

THE Army Council has been notified by the Board of Inland Revenue that the bonus issuable to officers and other ranks selected for retention for military service, and to those who have not been released from military service by May 1st, is subject to income tax.

Medical News.

LIEUT.-COLONEL NATHAN RAW, M.D., M.P., has been appointed a member of the Committee of Inquiry into rates and qualifications for old age pensions.

SIR ARCHIBALD GARROD, K.C.M.G., physician to St. Bartholomew's Hospital, after three years' service abroad as temporary Colonel, A.M.S., has returned to civil practice in London.

THE Rockefeller General Education Board has set aside £80,000 as an endowment for a department of obstetrics in the Johns Hopkins Medical School, Baltimore.

THE Silvanus Thompson Memorial Lecture of the Röntgen Society will be delivered by Professor W. M. Bayliss, M.A., D.Sc., F.R.S., in the Barnes Hall of the Royal Society of Medicine on Tuesday, May 6th, at 8 p.m.

THE house and library of the Royal Society of Medicine will be closed from Thursday, April 17th, to Tuesday, April 22nd (both days inclusive), but members of the R.A.M.C. and other medical services will be admitted except on Good Friday and Easter Monday.

IT has been decided to resume the annual dinner in London of the officers of the Indian Medical Service. The dinner will be held this year at the Trocadero on Wednesday, June 11th. Further information can be obtained from Colonel J. J. Pratt, I.M.S. (ret.), 63, Addison Road, Kensington, W.14.

ON February 27th a marble plate, to which is fixed the medal of honour of the Assistance Publique, was awarded to the Lariboisière Hospital by the municipality of Paris in commemoration of the services rendered by the staff of the hospital to the people of Paris under bombardment, especially after the great explosion of the Courneuve, when it admitted more than four hundred casualties. Certain other hospitals were damaged; in 1918 bombs fell on the Saint-Antoine, Broca, Cochin, Claude-Bernard, and the Maternity, causing considerable loss of life.

IT was reported to the London Insurance Committee, on March 27th, that 512 discharged soldiers, entitled under the special arrangements to priority, and 473 of the ordinary insured population, were at present undergoing residential treatment in sanatorium or hospital, and that the waiting list of applicants for sanatorium benefit for whom beds were not available was reduced to twelve.

THE first Spanish National Congress of Medicine, which was to have been held in October last but had to be postponed on account of the epidemic of influenza, is to be held in Madrid from April 20th to 25th. The Congress is under the patronage of King Alphonso, who will be present at the opening meeting. The number of members already registered is 2,970. Receptions will be given by the King and the Municipal Council of Madrid. Occasion will be taken to found a Spanish Medical Association for the protection of the interests of the profession.

A GENERAL meeting of the National League for Health, Maternity and Child Welfare, and of its constituent sections, will be held in the Council Chamber, Guildhall, London, on Monday, April 14th, at 3 p.m., under the chairmanship of the Lord Mayor. Major Waldorf Astor and Viscountess Rhondda will discuss the Ministry of Health, and Lady Ampthill the proposals of the Red Cross Society for helping the civil population in peace. The annual report for 1918 has now been issued. The aim of the League is to form a link between the many voluntary national organizations concerned in safeguarding the health of the nation at large and of mothers and young children in particular. The office of the League is at 4, Tavistock Square, W.C.1.

A CONFERENCE was held on April 2nd, at the Local Government Board, with representatives of the port sanitary authorities of the principal English ports and their medical officers, to consider preventive measures against the importation of infectious diseases into this country from abroad owing to the resumption of passenger sea traffic. In view of the prevalence of typhus, smallpox, and other infectious diseases on the Continent, particularly in the east of Europe, the medical advisers of the Local Government Board regard it as essential that the utmost vigilance should be exercised, and the Board will take steps to strengthen the powers and duties of port sanitary authorities. The conference also discussed the arrangements for medical examination of aliens in connexion with proposed legislation. On the establishment of a Ministry of Health steps will probably be taken to combine the present medical work of the port sanitary authorities with the medical examination of aliens.

Letters, Notes, and Answers.

AUTHORS desiring reprints of their articles published in the BRITISH MEDICAL JOURNAL are requested to communicate with the Office, 429, Strand, W.C.2, on receipt of proof.

IN order to avoid delay, it is particularly requested that ALL letters on the editorial business of the JOURNAL be addressed to the Editor at the Office of the JOURNAL.

The postal address of the BRITISH MEDICAL ASSOCIATION and BRITISH MEDICAL JOURNAL is 429, Strand, London, W.C.2. The telegraphic addresses are:

1. EDITOR of the BRITISH MEDICAL JOURNAL, *Aitiology, Westrand, London*; telephone, 2631, Gerrard.
2. FINANCIAL SECRETARY AND BUSINESS MANAGER (Advertisements, etc.), *Articulate, Westrand, London*; telephone, 2630, Gerrard.
3. MEDICAL SECRETARY, *Mediseora, Westrand, London*; telephone, 2634, Gerrard. The address of the Irish Office of the British Medical Association is 16, South Frederick Street, Dublin.

LETTERS, NOTES, ETC.

THE SPREAD OF RABIES.

THE Rabies Order recently issued for Monmouthshire and portions of the counties of Glamorgan, Brecknock, Gloucester, and Hereford, has raised the question of what a medical man should do in case he is called to a person in these areas who has been bitten by a dog suspected to be rabid. The Local Government Board issued a memorandum some time ago advising that any person bitten by a dog in areas in which rabies in dogs is suspected should have the wound treated as soon as possible with undiluted carbolic acid, or with undiluted izal or similar disinfectant, which should be allowed to come into contact with all parts of the wound; it should then be washed out with water or dilute disinfectant. If the dog is pronounced, on competent veterinary authority, to have had rabies, the person bitten should be urged to secure specific antirabic treatment as soon as possible, no matter what local treatment has been applied to the bite. The specific treatment can be given at Plymouth with material supplied for the purpose by the Director of the Pasteur Institute in Paris. The treatment is given for the Local Government Board by Dr. W. L. Pethybridge, Pathologist of the South Devon and East Cornwall Hospital; communications for him should be addressed to 11, Whitefield Terrace, Plymouth. Pending the decision as to whether the dog is rabid, the medical officer of the district in which the bitten person lives should be informed, and the person should be told to be prepared, if so advised, to go to Plymouth for antirabic treatment on receipt of a telegram.

IODINE IN INFLUENZA.

DR. W. THOMAS (Rhyl, North Wales) writes: I note with pleasure in your last issue that Dr. Andrés Sobrino of Madrid speaks enthusiastically of the efficacy of the tincture of iodine in influenza. The authorities of a dimmer therapeutic age than the present condemned it as unsuitable for internal administration because of its liability to produce iodism. There never was a greater error, but such is the power of tradition that when I try to persuade my brother practitioners to use it I am speaking to deaf ears. For many years I have prescribed the drug extensively in many conditions, and I owe much of the success I have achieved as a practitioner to its efficacy. The pharmacopoeial dose is practically useless; it must be given in doses of from 10 to 60 minims, well diluted. I have often taken ʒj in a tumbler of water, and have averted many a threatening cold or an attack of influenza by so doing. It is excellent, combined with an alkali, in acid dyspepsia. I have never known it to produce the bugbear "iodism," and my own experience fully justifies Dr. Sobrino's enthusiastic praise. It is one of the best drugs in the *British Pharmacopoeia*, either externally or internally used.

SUPERANNUATION OF MEDICAL OFFICERS.

"EFFICIENCY" writes: As a strong committee is about to be formed in favour of legislation for superannuation of Scottish Local Government officials, including parochial medical officers, I hope the special claims of the medical officers of the Highland and Island parishes will receive the consideration they deserve. The medical officer who has served for fifteen or twenty years in these isolated parishes, doing Government and national work, ought to be eligible for pension.

SCALE OF CHARGES FOR ADVERTISEMENTS IN THE BRITISH MEDICAL JOURNAL.

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NOTE.—It is against the rules of the Post Office to receive *poste restante* letters addressed either in initials or numbers.